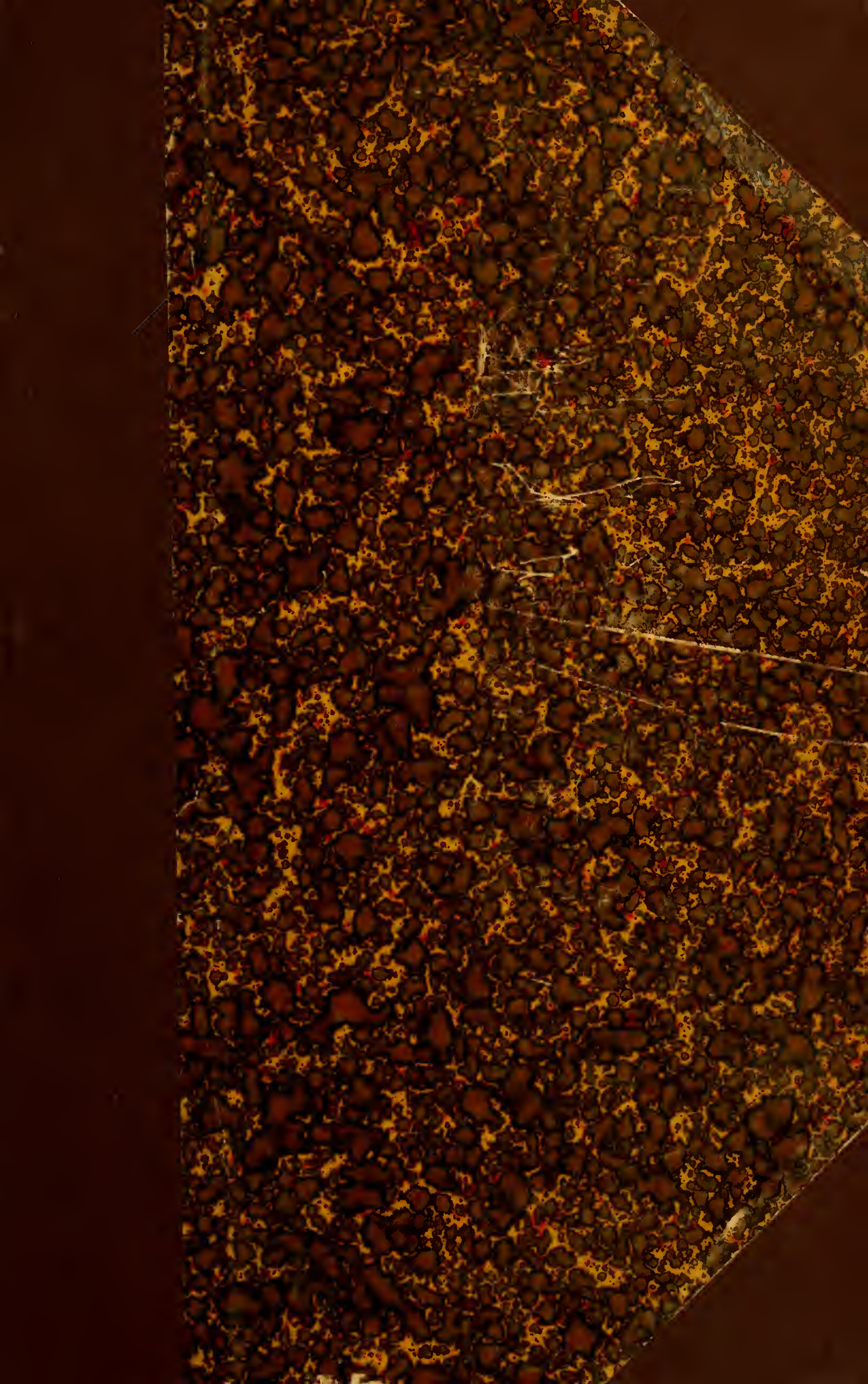

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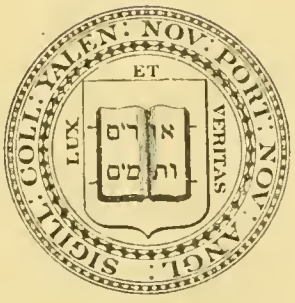

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ADDITIONS TO THE LIBRARY

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American Academy of Arts and Sciences.
Proceedings. Vol. XLII. 14–XLIII. 14. 1907–1908.
American Antiquarian Society.
Proceedings. New Ser. Vol. XVIII. 1–3. 1906–1907.
American Astronomer.
I. 1–2. 1907.
American Entomological Society.
Transactions. Vol. XXXI. 1–4. 1905.
American Geographical Society.
Bulletin. Vol. XXXIX. 1–XL. 2. 1907–1908.
American Museum of Natural History (New York).
Bulletin. Vol. XXII. 22–30; XXIII. 1–36; XXIV. 1–2. 1907–1908.
AMHERST COLLEGE.
Catalogue. 1906–1907; 1907–1908.
AMSTERDAM.—*Kon. Akademie van Wetenschappen.*
Jaarboek. 1906.
Proceedings. Section of sciences. Vol. IX. 1–2. 1907.
Verhandelingen. Afdeel. Natuurkunde. Sectie I, Deel IX. 4; Sectie II, Deel XIII. 1–3. 1907.
Verslagen van de gewone vergaderingen van de wis- en natuurkundige afdeeling. Deel XV. 1–2. 1907.
Annalen der Hydrographie und Maritimen Meteorologie: Zeitschrift für Seefahrt und Meereskunde.
Bd. XXIX–XXXVI. 3. 1901–1908.
AUGSBURG.—*Naturwissenschaftlicher Verein für Schwaben und Neuburg.*
Bericht. XXXVII. 1906.
BASEL.—*Naturforschende Gesellschaft.*
Verhandlungen. Bd. XIX. 1–2. 1907.
BATAVIA.—*Kon. Natuurkundige Vereeniging in Nederlandsch-Indië.*
Natuurkundige tijdsschrift, Deel LXVI. 1907.
———R. Magnetical and Meteorological Observatory.
Observations. Vol. XXVIII and Appendices II–III. 1905.
Regenswaarnemingen in Nederlandsch-Indië. Jaarg. XXVII–XXVIII. 1905–1906.
BERGEN.—*Museum.*
Aarbog. 1906, I–III; 1907, I.
Aarsberetning. 1906.
Account of the crustacea of Norway. By G. O. Sars. Vol. V. 13–16. 1906.
Meeresfauna von Bergen, Appellöf. II. 2–3.

BERLIN.—*Kön. Museum für Naturkunde.*
Bericht. 1906.
Mitteilungen aus der zoologischen Sammlung. Bd. III. 3. 1907.
Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History, Honolulu, S. I.
Occasional Papers. Vol. II. 5; III. 1. 1906–1907.
BOLIVIA.—*Ministerio de Colonización y Agricultura.*
Revista. Año III. Tomo III. 23. 1907.
BOLOGNA.—*R. Accademia delle Scienze dell'Istituto di Bologna.*
Memorie. Classe di Scienze Morali. Sezione di Scienze Giuridiche Ser. I. Tomo I. Fasc. I. 1906–1907.
Sezione di Scienze Storico-Filologiche.
Ser. I. Tomo I. Fasc. I. 1906–1907.
Rendiconto. N. S. Vol. IX–X. 1904–1906.
Classe di Scienze Morali. Ser. I. Tomo I. Fasc. I. 1908.
BOMBAY.—*Bombay Branch of the Royal Asiatic Society.*
Journal. No. LXI–LXII. 1906–1907.
BONN.—*Naturhistorischer Verein der preussischen Rheinlande, Westfalens und des Regierungs-Bezirks Osnabrück.*
Sitzungsberichte der niederrheinischen Gesellschaft für Natur- und Heilkunde. 1905. 2–1907. 1.
Verhandlungen. LXII. 2–LXIV. 1. 1905–1907.
BORDEAUX.—*Commission Météorologique de la Gironde.*
Observations pluviométriques et thermométriques. Juin, 1905 à mai, 1906.
Société des Sciences Physiques et Naturelles.
Cinquantenaire. Jan. 15–16, 1906.
Procès-verbaux. Année. 1905–1906.
BOSTON.—*Museum of Fine Arts.*
Annual report. 31st–32d. 1906–1907.
Bulletin. No. 24–31. Feb. 1907–Feb. 1908.
Society of Natural History.
Proceedings. Vol. XXXIII. 4–XXXIV. 1. 1907.
BREMEN.—*Meteorologisches Observatorium.*
Deutsches meteorologisches Jahrbuch. Jahrg. XVII. 1906.
Naturwissenschaftlicher Verein.
Abhandlungen. Bd. XIX. 1. 1907.
BRESLAU.—*Schlesische Gesellschaft für vaterländische Cultur.*
Jahres-Bericht. LXXXIV and Ergänzungsheft. 1906.
BROOKLYN.—*Museum of the Brooklyn Institute of Arts and Sciences.*
Science bulletin. Vol. I. 10–13. 1907–1908.
BRÜNN.—*Naturforschender Verein.*
Bericht der meteorologischen Commission. XXIV. 1906.
Verhandlungen. Vol. XLIV. 1905.
BRUXELLES.—*Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique.*
Bulletins. Classe des sciences. 1906. 5–1907. 8.
Annuaire. LXIII. 1907.
Mémoires de la classe des sciences. 2e Sér. Tome I. Fasc. III–VIII; Tome II. Fasc. I–II.
Musée Royal d'Histoire Naturelle de Belgique.
Mémoires. Tome III. 1906.
Observatoire Royale de Belgique.
Annales Astronomiques. T. IX. 2–3, 1906–1907; T. XI. 1, 1907.
Annales: Bulletin climatologique de l'année 1899. 1–2.
Annales. Nouv. sér., Annales météorologiques. T. V–XI. XIII–XIV. 1901–1904.
Annales: Observations météorologiques faites à Uccle pendant l'année 1900, 1901.

BRUXELLES.—*Observatoire Royale de Belgique.*
Annales: Physique du globe. Nouv. sér., T. III. 2–3. 1907.
Annuaire astronomique pour 1907, 1908.
Annuaire météorologique pour 1901–1906.
Société Entomologique de Belgique.
Annales. Tome L. 1907.
Société Royale de Botanique.
Bulletin. Vol. XLII. 3; XLIII. 1–3. 1904–1906.
BUCAREST.—*Institut météorologique de Roumanie.*
Annales. Tome XVIII. 1902.
Société des Sciences.
Bulletin. Vol. XV. 5–6; XVI. 3–6. 1906–1907.
BUDAPEST.—*Königlich Ungarische Reichsanstalt für Meteorologie und Erdmagnetismus.*
Bericht. 1905.
Jahrbücher. Jahrg. XXXIII. 4–XXXIV. 3; XXXV. 1–4. 1903–1905.
Bibliothek, Verzeichniss erworbener Bücher. 1905 (4).
BUENOS AIRES.—*Museo Nacional.*
Anales. Ser. 3. Vol. VI–VIII. 1907–1908.
Sociedad Cientifica Argentina.
Anales. LXII. 2–LXIV. 3. 1906–1907.
BUFFALO.—*Society of Natural Sciences.*
Bulletin. Vol. VIII. 4–6.
CAEN.—*Société Linnéenne de Normandie.*
Bulletin. 5e sér. Vol. IX. 1905.
CALCUTTA.—*Asiatic Society of Bengal.*
Journal and proceedings. Vol. II. 4–10; III. 1–4. 1906–1907.
Memoirs, Vol. I. 10–19; II. 1–4. 1907.
California Academy of Sciences
Proceedings. Vol. I, pp. 1–6, 4th ser.
CAMBRIDGE (England).—*Philosophical Society.*
List of Fellows, etc. August, 1907.
Proceedings. Vol. XIV. 1–4. 1907.
Transactions. Vol. XX. 11, 13–16. 1907.
CANADA.—*Geological Survey.*
Preliminary report on Rossland, B. C., mining district. By Brock. 1906.
Report on Chibougamau mining region. By Low. 1905.
Annual report of the section of mines. 1904–1905.
Geological map of the Dominion of Canada. Sheets Nos. 59–65; 74–76; 82–83.
Summary report of the department of mines. 1905–1907.
CATANIA.—*Accademia Gioenia di Scienze Naturali.*
Atti. Ser. IV. Vol. XIX. 1907.
Bolletino delle Sedute. Nuova serie. Fasc. 92. 1907.
Società degli Spettroscopisti Italiani.
Memoire. Vol. XXXIV. 7; XXXV. 6.
Cellule (La). Vol. XXII. 1–2; XXIII. 1–2; XXIV. 1–2. 1905–1907.
CHERBOURG.—*Société Nationale des Sciences Naturelles.*
Mémoires. Tome XXXV. 1907.
CHICAGO.—*Field Museum of Natural History.*
Publications. 115, 117–126. 1907–1908.
CHRISTIANIA.—*Videnskabs Selskabet.*
Forhandlinger. 1906.
CHUR.—*Naturforschende Gesellschaft Graubündens.*
Jahresbericht. Neue Folge. Bd. XLVIII–XLIX. 1905–1907.
CINCINNATI.—*Museum Association.*
Annual exhibition. Vol. XIV. 1907.
Annual report. Vol. XXVI. 1906.

CINCINNATI.—*University.*
Teachers' bulletin. Vol. III. 5. S. ser. 3. 1907.
Record. Ser. 1. Vol. III. 2–3; IV. 1–4. 1906–1908.
University Studies. Ser. 2. Vol. II. 3–4; III. 1. 1906–1907.
Colorado College.
Publications. General series. No. 24, 26, 29–33.
Scientific Society.
Proceedings. Vol. II. 1–3; III. 1–3; IV–VI; VII, pp. 53–VIII, pp. 422; IX, pp. 5–20.
Colorado, University of.
Studies. Vol. IV–V. 1.
COPENHAGEN.—*L'Académie Royale des Sciences et des Lettres de Danemark.*
Bulletin (Oversigt). 1906, no. 4–6; 1907, 1–4.
Naturhistoriske Forening.
Videnskabelige Meddelelser. 1906.
CRACOW.—*Akademija Umiejetnosci.*
Komisya fizyjograficzna. Materyay zebrane przez. Sekcye meteorologiczna w roku 1905. (Spraw. Kom. fizyogr. T. 40. Czesc I.)
K. K. Sternwarte.
Meteorologische Beobachtungen, Oct., 1906, bis Feb., 1907.
Resultate der meteorologischen Beobachtungen. 1907.
DANZIG.—*Naturforschende Gesellschaft.*
Schriften. Neue Folge. Bd. XII. 1. 1908.
DAVENPORT, IA.—*Academy of Sciences.*
Proceedings. Vol. X–XII, p. 94. 1906–1907.
DENISON UNIVERSITY.
Bulletin of the Scientific Laboratories. Vol. XIII. 4–6. 1907.
DIJON.—*Académie des Sciences, Arts et Belles Lettres.*
Mémoires. Sér. IV. Tome X. 1905–1906.
DORPAT.—*Naturforscher-Gesellschaft bei der Universität Dorpat.*
Schriften. Bd. XVII. 1907.
Sitzungsberichte. Bd. XIV. 2; XV. 1–4; XVI. 1–2. 1905–1907.
Verzeichnis der Editionen. General-Namenregister zu den Bänden. III–XIV. 1869–1905.
Universität. Institut Zootomique.
Bulletin biologique. No. 1. 1907.
DRESDEN.—*Naturwissenschaftliche Gesellschaft Isis.*
Sitzungsberichte und Abhandlungen. Juli, 1906, bis Juni, 1907.
Verein für Erdkunde.
Mitteilungen. Heft 6. 1907.
DUBLIN.—*Royal Dublin Society.*
Economic proceedings. Vol. I. 9–11. 1907.
Scientific proceedings. New ser. Vol. V. 7; XI. 13–19. 1907.
Scientific transactions. Ser. II. Vol. V. 6; IX. 4–6. 1907.
EDINBURGH.—*Geological Society.*
Transactions. Vol. IX, part 1. 1907.
Royal Observatory.
Annals. Vol. II. 1906.
Royal Physical Society.
Proceedings. Vol. XVI. 7; XVII. 2–3. 1907.
Royal Society.
Proceedings. Vol. XXVI. 6; XXVII. 1–5; XXVIII. 1–2. 1906–1907.
Elisha Mitchell Scientific Society.
Journal. Vol. XXII. 3; XXIII. 1–3. 1906–1907.
EMDEN.—*Naturforschende Gesellschaft.*
Jahresbericht. XC. 1904–1905.
ERFURT.—*Kön. Akademie gemeinnütziger Wissenschaften.*
Jahrbücher. Neue Folge. Heft XXXII–XXXIII. 1906–1907.
FLORENCE, ITALY.—*Biblioteca Nazionale Centrale.*
Bolletino delle Pubblicazioni Italiane, 73–87, Jan., 1907–Mch., 1908.

FRANKFURT A. M.—Deutsche Malakozoologische Gesellschaft.
Nachrichtsblatt. Jahrg. XXXIX–XL. 1. 1907–1908.
Senckenbergische Naturforschende Gesellschaft.
Abhandlungen. Bd. XXIX. 2; XXX. 3. 1907–1908.
Berlcht. 1906, 1907.
Franklin Institute.
Journal. Vol. CLIX–CLXV. 3. 1905–1908.
FREIBURG I. B.—*Naturforschende Gesellschaft.*
Berichte. Bd. XV. 1907.
GENEVA.—*Société de Physique et d'Histoire Naturelle.*
Mémoires. Tome XXXV. 3. 1907.
GENOA.—*Musco Civico di Storia Naturale.*
Annali. Ser. 3. Vol. II. 1905–1906.
GERMANY.—*Kais. Leopoldinisch-Carolinische deutsche Akademie der Naturforscher.* (Halle a. S.).
Leopoldina. Heft XLII. 1906.
GIESSEN.—*Oberhessische Gesellschaft für Natur- und Heilkunde.*
Bericht. Neue Folge. Medizinische Abteilung. Bd. II. 1907.
Naturwissenschaftliche Abteilung. Bd. I. 1904–1906.
GLASGOW.—*Natural History Society.*
Transactions. New ser. Vol. VII. 3. 1904–1905.
Royal Philosophical Society.
Proceedings. Vol. XXXVII. 1905–1906.
GÖRLITZ.—*Naturforschende Gesellschaft.*
Abhandlungen. Bd. XXV. 2. 1907.
GÖTEBORG.—*Kon. Vetenskaps och Vitterhets Samhälle.*
Handlingar. 4de följ. Häft. VII–IX. 1906.
GÖTTINGEN.—*Kön. Gesellschaft der Wissenschaften.*
Nachrichten. Geschäftliche Mittheilungen. 1906, 2; 1907, 1–2.
Philosophisch-historische Klasse. 1906, 3–4 und Beiheft; 1907, 1–3 und Beiheft.
HALIFAX.—*Nova Scotian Institute of Natural Science.*
Proceedings and transactions. Vol. XI. 2. 1903–1904.
Department of Mines, Nova Scotia.
Report. 1906.
HALLE A. S.—*Naturforschende Gesellschaft.*
Abhandlungen. Bd. XXXV. 1903–1906.
HAMBURG.—*Deutsche Seewarte.*
Aus dem Archiv. Jahrg. XXIX. 2; XXX. 1–2. 1906–1907.
Deutsches meteorologisches Jahrbuch. Jahrg. XXVIII. 1905.
Katalog der Bibliothek. Nachtrag. Bd. VII. 1905–1906.
Naturwissenschaftlicher Verein.
Abhandlungen. Bd. XIX. 1–2. 1907.
Verhandlungen. 3te Folge. XIV. 1907.
HARLEM.—*Musée Teyler.*
Archives. Sér. II. Vol. X. 3–4; XI. 1. 1907.
Société Hollandaise des Sciences.
Archives néerlandaises. Sér. II. Tome XII. 1–5; XIII. 1–2. 1907.
HARVARD COLLEGE.—*Astronomical Observatory.*
Annual report. 1906–1907.
Annals. Vol. XLVII. 1; XLIX. 1; LII. 1; LV. 1; LVII. 1; LIX. 1; LX. 3–8; LXII. 1. 1907.
Circulars. No. 119–135.
Museum of Comparative Zoölogy.
Annual report. 1905–06; 1906–07.
Memoirs. XXXIV. 1; XXXV. 1–2. 1907.
Bulletin. Vol. XLIII. 5; XLVIII. 4; L. 6–9; LI. 1, 4–10. 1907–1908.

HARVARD COLLEGE.—*Museum of Comparative Zoology.*
Bulletin. Geological ser. Vol. VIII. 5–6. 1908.
HAVANA.—*Real Colegio de Belen.*
Observaciones meteorologicas y magneticas. 1906.
HELSINGFORS.—*Societas Scientiarum Fennica.*
Observations publiés par l'Institut Météorologique Central. 1895–96 (hiver).
Acta. Tome XXXII. 1906.
Bidrag till kännedom af Finlands natur och folk. Häft. 63. 1905.
Öefversigt af förhandlingar. XLVII. 1904–1905.
Societas pro Fauna et Flora Fennica.
Acta. Vol. XXVII–XXVIII. 1905–1906.
Meddelanden. Vol. XXXI–XXXII. 1904–1906.
HERMANNSTADT.—*Siebenbürgischer Verein für Naturwissenschaften.*
Verhandlungen und Mittheilungen. Bd. LV–LVI. 1905–1906.
ILLINOIS.—*State Laboratory of Natural History.*
Bulletin. Vol. VII. 6–9. 1906–1907.
INDIA.—*Imperial Department of Agriculture.*
Memoirs. Botanical series. Vol. I, No. 1, Part II; I. 6; II. 1–2, 4 1907.
Memoirs. Chemical series. Vol. I. 2–5. 1907.
Memoirs. Entomological series. Vol. I. 2–5. 1907.
Agricultural Research Institute (Pusa). Bulletin. No. 4. 1906.
Geological Survey of India.
Memoirs. Series XV. Vol. V. 1–2. 1907.
Records. Vol. XXXIV. 3–XXXVI. 2. 1906–1907.
Palaeontologia Indica. New ser. Vol. II. 3. 1906.
Meteorological Department of the Government of India.
Indian meteorological memoirs. Vol. XVIII. 1, 3. 1907–1908.
Monthly weather review. May, 1906, to Jan., 1907.
India weather review. Annual summary. 1905.
Rainfall of India. 1905.
Report on administration. 1906–07.
Board of Scientific Advice.
Annual report. 1905–06.
INDIANA.—*Academy of Science.*
Proceedings. 1894–1896; 1904–1906.
Ingegneria Ferroviaria (Rome). Vol. IV. 18. 1907.
IOWA.—*Academy of Sciences.*
Proceedings. Vol. VIII; XIII. 1906.
Geological Survey.
Annual report. Vol. XVI. 1905.
IRKUTSK.—*Observatoire Physique Central Nicolas.*
Annales. Supplément. 1903.
ITALY.—*Reale Comitato Geologico d'Italia.*
Bulletino. Vol. XXXVII. 3–4. 1907.
Jenaische Zeitschrift für Naturwissenschaft.
Vol. XXXV. 1–3; XXXVI. 1–2. 1907.
John Crerar Library.
Annual report. 1906.
Handbook. 1907.
Johns Hopkins University.
Circular. 1906, 10; 1907, 1–9; 1908, 1.
Journal of Comparative Neurology and Psychology.
Vol. XVII. 1–4. 1907.
KANSAS.—*Academy of Science.*
Transactions. Vol. I–III; XVIII–XX. 2; XXI. 1. 1907.
University of Kansas.
Bulletin. Vol. VII. 5; VIII. 3. 1907.

KASAN.—*Société Physico-mathématique de l'Université Impériale.*
Bulletin. Sér. II. Tome XV. 2–3. 1905–1906.

KIEL.—*Naturwissenschaftlicher Verein für Schleswig-Holstein.*
Schriften. Bd. XIII. 2. 1907.

Kön. Christian Albrechts-Universität.
Chronik. 1905–06.
Verzeichnis der Vorlesungen. 1905–06, Winter Semester; 1906, Sommer Semester.
109 dissertations. 1905–1906.

KIEV.—*Société des Naturalistes.*
Mémoires. Tome XX. 2. 1907.

KODAIKÁNAL.—*Observatory.*
Bulletin. No. 7–11. 1907.
Annual Report. 1906.

KYOTO.—*College of Science and Engineering, Imperial University.*
Memoirs. Vol. I. 3. 1906–1907.

LA PLATA.—*Archivos de Pedagogia y Ciencias Afines.*
No. 4–9. 1907–1908.

Museo.
Anales. Seccion botanica. Tome I (1902).
Seccion paleontologica. Tome V (1903).
Revista. Tome XI (1904).

LAUSANNE.—*Société Vaudoise des Sciences Naturelles.*
Bulletin. 5e sér. Vol. XLII. no. 156–XLIII. 160. 1906–1907.

LEIDEN.—*Nederlandsche Dierkundige Vereeniging.*
Catalogus der bibliotheek, 5de uitgave. 1907.
Tijdschrift. Ser. II. Deel X. 3. 1907.

Sternwarte.
Annalen. Bd. IX. 1. 1907.
Verslag. 1904–1906.

LEIPZIG.—*Kön. Sächsische Gesellschaft der Wissenschaften.*
Berichte. Mathematisch-physische Klasse. Bd. LVIII. 3, 5–8; LXIX. 1–3. 1906–1907.

Fürstl. Jablonowski'sche Gesellschaft.
Jahresbericht. 1907.

Naturforschende Gesellschaft.
Sitzungsberichte. 1899–1906.

LEMBERG.—*Sercenko-Gesellschaft der Wissenschaften.*
Chronik. 1906, 3–4; 1907, 1–3.
Sammelschrift der mathematisch-naturwissenschaftlich-ärztlichen Section. Bd. XI. 1907.

LIÈGE.—*Société Royale des Sciences.*
Mémoires. Sér. III. Tome VI–VII. 1907.

LIMA.—*Cuerpo de Ingenièros de Minas del Perú.*
Boletin. No. 41, 44–49, 51–54. 1907–1908.

LISBON.—*Sociedade de Geographia.*
Boletim. Serie XXIV. 9–XXV. 12. 1906–1907.

LONDON.—*Geological Society.*
Geological literature added to the library. 1906.
Quarterly Journal. Vol. LXIII. 1–3; LXIV. 1. 1907–1908.

Linnean Society.
Journal. Zoölogy. No. 191–196, 203. 1905–1907.
List. 1907–1908.
Proceedings. 1906–1907.

Royal Society.
Reports of the Commission on the Mediterranean fever. Parts V–VII. 1907.
Reports on Ceylon pearl oyster fisheries, by W. A. Herdman. V. 1907.

LONDON.—*Royal Society.*
Philosophical transactions. Series A. No. 414–427. 1907–1908.
Series B. No. 252–259. 1907–1908.
Proceedings. Series A. No. 526–537. 1907–1908.
Series B. No. 528–536. 1907–1908.
Royal Microscopical Society.
Journal. 1907–1908. 1.
LOUISIANA.—*State Board of Agriculture and Immigration.*
Gulf Biologic Station. Bulletin. No. 6–7. 1907.
LUXEMBOURG.—*Institut Grand-Ducal.*
Archives trimestr. Tome I. Fasc. II–III. 1906.
LYONS.—*Société d'Agriculture, Sciences et Industrie.*
Annales. 1906.
MADRID.—*Comisión del Mapa Geológico de España.*
Boletin. 2a ser. Tomo VIII. 1906.
Memorias. Tome VI. 1907.
Observatorio Astronomico.
Anuario. 1907–1908.
Resumen de las observaciones meteorológicas. 1899–1900.
MANCHESTER, ENGLAND.—*Literary and Philosophical Society.*
Memoirs and proceedings. Vol. LI. 1–3; LII. 1. 1906–1908.
MANCHESTER, N. H.—*Institute of Arts and Sciences.*
Proceedings. Vol. IV. Part. I. 1902.
MARBURG.—*Gesellschaft zur Beförderung der gesammten Naturwissenschaften.*
Sitzungsberichte. Jahrg. 1906.
MECKLENBURG.—*Verein der Freunde der Naturgeschichte in Mecklenburg.*
Archiv. Jahrg. LX. 2; LXI. 1. 1906–1907.
MERIDEN.—*Scientific Association.*
Transactions. Vol. VI. 1893.
MEXICO.—*Instituto Geológico de México.*
Boletin. No. 22, 24. 1906–1907.
Observatorio Astronomico Nacional de Chapultepec.
Anuario. Tome XXVII–XXVIII. 1907–1908.
Observatorió Meteorológico Central.
Boletin mensual. July–Sept., 1904; July–Oct., 1907.
Observatorio de Tacubaya y Cuajimalpa.
Observaciones meteorológicas. Año de 1904.
Sociedad Cientifica "Antonio Alzate."
Memorias y revista. Tomo XXIII. 5–12; XXIV–XXV. 2. 1907–1908.
MIDDELBURG.—*Zeeuwsch Genootschap der Wetenschappen.*
Archief. 1906, 1907.
Catalogus der numismatische versameling. By G. A. De Man. 1907.
Verslag. 1893–1902.
MILAN.—*Real Istituto Lombardo di Scienze e Lettere.*
Rendiconto. Serie II. Vol. XXXIX. 17–20; XL. 1–15. 1908.
Reale Osservatorio di Brera.
Publicazioni. XLIII–XLIV. 1907–1908.
Società Italiana di Scienze Naturali.
Atti. XLV. 3–4; XLVI. 1–2. 1907.
MILWAUKEE.—*Public Museum.*
Annual report. XXV. 1907.
MISSOURI.—*Botanical Garden.*
Annual report. XVIII. 1907.
University of Missouri.
Studies. Science series. Vol. I. 2; II. 1. 1907–1908.
Laws Observatory. Bulletin. No. 8–11. 1907.
MODENA.—*Regia Accademia delle Scienze, Lettere ed Arti.*
Memorie. Serie III. Tom. VI. 1907.

MONTEVIDEO.—*Museo Nacional.*
Anales. Tome III. Entrega 1–2. 1907.
Observatorio Nacional Fisico-Climatológico.
Boletin. Tomo VI. 52–54. 1907.
MONTPELLIER.—*Académie des Sciences et Lettres.*
Mémoires. Section des lettres. Sér. II. Tome III. 3. 1907.
Section des sciences. Sér. II. Tome III. 5–7. 1907.
MOSCOW.—*K. Universität, Meteorologisches Observatorium.*
Beobachtungen. 1903, 1904.
Société Impériale des Naturalistes.
Bulletin. Année 1905, 4; 1906, 1–4.
MUNICH.—*Kön. Baycrische Akademie der Wissenschaften.*
Sitzungsberichte. Mathematisch-physikalische Classe. 1905, III; 1906, I–II; 1907, I–III.
Philosophisch-philologisch und historische Classe. 1904, IV; 1905, V; 1906, I–II; 1907, I–III.
Kön. Sternwarte.
Neue Annalen. Supplementheft. I. 1907.
Mycological Notes.
No. 21–26. 1906–1907.
NANCY.—*Académie de Stanislas.*
Mémoires. 6e sér. Tome IV. 1906–1907.
NAPLES.—*R. Istituto d'Incoraggiamento alle Scienze Naturali, etc.*
Atti. Ser. VI. Vol. LVII–LVIII. 1905–1906.
R. Universitá.
Annuario del Museo Zoologico. N. S. Vol. II. 1–16. 1907.
R. Accademia di Scienze Morali e Politiche.
Atti. Vol. XXXVII. 1906.
R. Accademia delle Scienze Fisiche e Matematiche.
Rendiconto. Ser. III. Vol. XII. 5–12; XIII. 1–27. 1906–1907.
Naturae Novitates.
Vol. XXIX. 1–16, 21–24. 1907.
NEW BRUNSWICK.—*Natural History Society.*
Bulletin. No. XXV. Vol. V. Part V. 1907.
NEW YORK.—*Academy of Sciences.*
Annals. Vol. XVII. 2–3; XVIII. 1. 1907–1908.
Botanical Garden.
Bulletin. No. 14, 16–17. 1906–1907.
Linnaean Society.
Abstract of proceedings. No. 17–19. 1907.
Public Library.
Bulletin. Vol. XI–XII. 3. 1907–1908.
NEWCASTLE-UPON-TYNE.—*North of England Institute of Mining and Mechanical Engineers.*
Transactions. Vol. LIV. 9; LV. 6–7; LVI. 4–6; LVII. 1–2, 4–6; LVIII. 1–2. 1906–1908.
Subject-matter index of mining, mechanical and metallurgical literature for 1902.
Annual report of the council. 1906–1907.
NUREMBERG.—*Naturhistorische Gesellschaft.*
Abhandlungen. Bd. XVI. 1908.
Jahresbericht. 1905.
Oberlin College.
Laboratory bulletin. No. 13. 1907.
ODESSA.—*Observatoire Météorologique et Magnétique de l'Université.*
Annales. Année XIII. 1906.
OHIO.—*State Academy of Science.*
Proceedings. Vol. IV. Part 10. 1908.

Ohio.—*Geological Survey.*
Bulletin. No. 7. 4th ser. 1905.
Oxford.—*Radcliffe Library.*
Catalogue of books added. 1905, 1907.
University Observatory.
Astrographic catalogue. Vols. I–II. 1900.
Pacific Institution.
Publications. Special ser. No. 2. 1908.
Paris.—*Ecole Normale Supérieure.*
Annales. Tome XLI–XLIII. 1905–1907.
Ecole Polytechnique.
Journal. 2e sér. Cahier XI. 1907.
Musée Guimet.
Annales. Bibliothèque d'études. Tome XXII–XXIII. 1906–1907.
(Revue de l'histoire des religions.) Année XXVII. Tome LIV. 2–3. 1906.
Muséum d'Histoire Naturelle.
Bulletin. Année 1906, 6–7; 1907, 1–5.
Société Zoologique de France.
Mémoires. Tome XVIII. 1905.
Perth.—*Geological Survey of Western Australia.*
Bulletin. 23–26. 1907.
Philadelphia.—*Academy of Natural Sciences.*
Journal. 2d ser. Vol. XIII. Part 3. 1907.
Geographical Society.
Bulletin. Vol. V. 3–4; VI. 1. 1907–1908.
Pisa.—*Società Toscana di Scienze Naturali.*
Memorie. Tom. XXII. 1907.
Processi verbali. Tom. XVI. 1–5; XVII. 1–2. 1907–1908.
Pittsburgh.—*Carnegie Institute.*
Memorial of celebration (founder's day). XI. 1907.
Carnegie Museum.
Memoirs. Vol. II. 10; III. 1. 1907.
Publication. No. 46, 48–49. 1907.
Potsdam.—*Astrophysikalisches Observatorium.*
Publikationen. Bd. XV. 1; XVII; XVIII. 2. 1907.
Photographische Himmelskarte. Bd. IV. 1907.
Prag.—*Kön. böhmische Gesellschaft der Wissenschaften.*
Jahresbericht. 1906.
K. K. Sternwarte.
Astronomische Beobachtungen. 1900–1904.
Magnetische und meteorologische Beobachtungen. Jahrg. 1906.
Quebec.—*Literary and Historical Society.*
Historical Documents. 8th series. 1906.
Transactions. No. XXVII. 1906–1907.
Queensland.—*Geographical Journal.*
N. S. Vol. XXI–XXII. 1905–1907.
Regensburg.—*Historischer Verein von Oberpfalz und Regensburg.*
Verhandlungen. Bd. LVII. 1905.
Riga.—*Naturforscher-Verein.*
Korrespondenzblatt. Jahrg. L. 1907.
Rio de Janeiro.—*Museo Nacional.*
Archivos. Vol. XIII. 1905.
Rome.—*Reale Accademia dei Lincei.*
Atti. Serie V. Rendiconti. Classe di scienze fisiche, matematiche e naturali. Vol. XVI–XVII. 4. 1907–1908.
Rendiconto dell'adunanza solenne. 1907, Vol. II.
Accademia Pontificia de'Nuovi Lincei.
Atti. Anno LIX. 4–7; LX. 1–17. 1905–1907.

ROME.—*Reale Comitato Geologico d'Italia.*
Bolletino. 1907. 1–3.
Società Italiana delle Scienze.
Memorie di Matematica e di Fisica. Serie III. Tom. XIV. 1907.
ST. LOUIS.—*Academy of Science.*
Transactions. Vol. XVI. 5, 7–9; XVII. 1. 1907.
ST. PETERSBURG.—*Académie Impériale des Sciences.*
Bulletin. Sér. V. Tome XXI. 5–XXV. 1. 1904–1906.
Sér. VI. 1907, 1–18; 1908, 1–4.
Hortus Petropolitanus.
Acta. Tome XXV. 2; XXVI. 1; XXVII. 1. 1906–1908.
Comité Géologique.
Bulletin. Vol. XXIII. 7–XXV. 9. 1904–1906.
Mémoires. Nouv. sér. Liv. 3, 16, 18–21, 23–27, 29, 31, 33. 1905.
Imp. Russ. Geograf. Obshtchestvo.
Izviestiïa. Tome XLII. 2–3. 1906.
Institut des Mines de l'Impératrice Catherine II.
Annales. Vol. I. 1. 1908.
Russisch-Kaiserliche Mineralogische Gesellschaft.
Materialien zur Geologie Russlands. Bd. XXIII. 1. 1906.
Verhandlungen. Ser. II. Bd. XLIII. 2; XLIV. 1–2. 1905–1906.
Observatoire Constantin.
Etude de l'atmosphère. Fasc. II. 1907.
Observatoire Physique Central Nicolas.
Annales. 1904, I; II. 1–2.
SAN ANTONIO, TEXAS.—*Scientific Society.*
Bulletin. Vol. I. 1. 1905.
SIOUX CITY, IA.—*Academy of Science and Letters.*
Proceedings. Vol. I–II. 1903–1906.
Société Mathématique de France.
Bulletin. Vol. XXXV–XXXVI. 1. 1907–1908.
STOCKHOLM.—*Kongl. Svenska Vetenskaps-Akademie.*
Arkiv för Botanik. Bd. VI. 3–4. 1907.
Arkiv för Kemi, Mineralogi och Geologi. Bd. II. 4–6. 1907.
Arkiv för Matematik, Astronomi och Fysik. Bd. III. 2–4. 1907.
Arkiv för Zoologi. Bd. III. 3–4. 1907.
Arsbok. 1906–1907.
Handlingar. Ny följdjd. Bd. XLI. 4, 6–7; XLII. 1–9. 1907.
Meteorologiska Iakttagelser i Sverige. Bd. XLVI. 1904.
Meddelanden fran Nobelinstitut. Bd. I. 6–7. 1907.
Les prix Nobel en 1902, Suppl; 1904, 1905.
Observations météorologiques suédoises. Vol. XLVIII. 1906.
Kongl. Bibliotek.
Accessions-katalog. XX. 1905.
Entomologisk Forening.
Entomologisk Tidskrift. Arg. XXVII–XXVIII. 1906–1907.
STUTTGART.—*Verein für vaterländische Naturkunde in Württemberg.*
Jahreshefte. Jahrg. LXIII und Beilagen 1–2. 1907.
SYDNEY.—*Australian Museum.*
Memoir. IV. 10. 1907.
Records. VI. 4–5. 1907.
Report. LII. 1906.
Special catalogue. Vol. II. 1–2. 1907.
Linnean Society of New South Wales.
Proceedings. Series II. Vol. XXXI. 1–4; XXXII. 1–3. 1906–1907.
Royal Society of New South Wales.
Journal and proceedings. Vol. XXXIX–XL. 1905–1906.
TAXIDERMIST. 1907. 2.
TEXAS.—*Academy of Science.*

FROM THE AUTHORS AND PUBLISHERS.

Castillo (Francisco Fernández del). Memoria leida en la Sociedad Mexicana de Geografia y Estadistica: Concordancia entre los calendarios Nahuatl y Romano. México. 1907.

Dahl (Ove). Carl von Linnés Forbindelse med Norge. Trondhjem. 1907. From the K. Norske Videnskabers Selskab.

Galissard de Marignac (J.-C.). Oeuvres complètes. Hors-série des Mémoires de la Société de Physique de l'Histoire Naturelle de Genève. Tome I–II. Genève. 1840–1887. From the Society.

MacDonald (Arthur). A plan for the study of man.

Rudzki (M. P.). Ueber die Tiefe des Herdes des calabrischen Erdlebens vom 8. Sept., 1905. Cracovie. 1907. (Extrait du Bull. Acad. d. Sciences, Classe Math....jan., 1907.) From the K. K. Sternwarte, Krakau.

Stroobant (P.), Delvosal (J.), and others. Les observatoires astronomiques et les astronomes. Bruxelles. 1907.

Wellcome's photographic exposure record and diary, 1907. New York. 1907. From Messrs. Burroughs, Wellcome & Co.

Zawodny (J.). Ein Beispiel altrömischer Pietas. Wien. 1907. (Separat-Abdruck aus dem "Katholischen Schulfreund.")

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THE EFFECT OF DIET ON ENDURANCE

BASED ON AN EXPERIMENT, IN THOROUGH MASTICATION, WITH NINE HEALTHY STUDENTS AT YALE UNIVERSITY, JANUARY TO JUNE, 1906

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I.—The Effect of Diet on Endurance, Based on an Experiment with Nine Healthy Students at Yale University. January–June, 1906.

Introduction.

There appears to be very little literature on the subject of endurance. Since the epoch-making work of Mosso, much has been written on fatigue, and many varieties of ergographs have been constructed to record muscular fatigue; but no systematic study of endurance as such appears to have been made. Even the concept of endurance, as related to strength and fatigue, has been lacking. No correlations have been worked out between endurance and the factors upon which it depends, except that it has been a matter of common experience that endurance increases with exercise. In respect to diet, opinions as to its relation to endurance, so far as the writer knows, have rested on no better foundation than the personal impressions of adherents of special dietary systems, such as those of Salisbury, Dewey, Haig, Kellogg, and Fletcher. In Professor Chittenden's painstaking study on "Physiological Economy in Nutrition" he has shown that one result of a gradual and systematic reduction in proteid, from the amount ordinarily consumed, has been an increase in *strength*, but no data were obtained in respect to *endurance*.

The present experiment had a somewhat accidental origin. I was engaged in collecting statistics of labor-power in relation to various factors, among them especially diet. The data were collected because of their economic bearings and without any intention at first of making independent experiments. But some of my students, whom I had engaged to make computations and diagrams, became interested in the material with which they thus came in contact, and expressed a strong desire to try dietetic experiments upon themselves. Not being a physiologist, I asked Professor Chittenden if he could not take charge of these experiments for them. It so happened that on account of other similar work he was unable to do so, but suggested that I should conduct them myself. I have done so with considerable hesitation, not being equipped for physiologic studies. I have therefore restricted my attention to the simpler practical aspects of the problem, although some of the technical points have been inves-

tigated through the very kind coöperation of able colleagues. My thanks are especially due to Professor Chittenden and his co-workers, Professor Mendel and Dr. Underhill, for the aid rendered by the Sheffield Scientific School Laboratory in determining the nitrogen excreted, and for much helpful advice and criticism. I wish also to express my obligations to Dr. J. P. C. Foster for his services as medical adviser to the students; to Dr. W. G. Anderson, Director of the Yale Gymnasium, and his corps of assistants, through whom the endurance tests were conducted; to Professor Rettger for fecal tests; and to the subjects of the experiment themselves, Messrs. Bauer, Edwards, Lagerquist, Lawton, Mitke, Parmelee, Reeds, Taylor, and Weyman, whose patient submission to the painful tests of endurance was little short of heroic.

In January, 1906, the students above mentioned organized themselves into an eating club. The experiment began with an endurance test on January 14, and consisted of two main parts, each of which lasted about ten weeks.

The object of the first half of the experiment was to test the claims which have been made by Mr. Horace Fletcher, as to the effects upon endurance of thorough mastication combined with implicit obedience to appetite. Our conclusion in brief is that Mr. Fletcher's claims, so far as they relate to endurance, are justified.

Mr. Fletcher's method may be briefly[1] expressed in two rules.

1. *Mastication.* Thorough mastication of all food up to the point of involuntary swallowing, with the attention directed, however, not on the mechanical act of chewing, but on the tasting and enjoyment of the food; liquid foods to be sipped and tasted, not drunk down like water. There should be no artificial holding of food in the mouth beyond the time of natural swallowing, even if, as is to be expected at the start, that swallowing is premature. It is not intended to "count the chews," or hold the food forcibly in the front of the mouth, or allow the tongue muscles to become fatigued by any unnatural effort or position, or in any other way to make eating a bore. On the contrary, every such effort distracts one from the natural enjoyment of food. Pawlow has shown that without such attention and enjoyment of the taste of food, the secretion of

[1] The reader who desires to pursue the subject is referred, as to mastication and instinctive eating, to Higgins, *Humaniculture*, Stokes, N. Y., 1906; as to proteid, to Chittenden, *Physiological Economy in Nutrition*, Stokes, 1904; and as to the general subject, to Horace Fletcher, *The A. B.-Z. of our own Nutrition*, Stokes, 1903.

gastric juice is lessened. The point of involuntary swallowing is thus a variable point, gradually coming later and later as the practice of thorough mastication proceeds, until the result is reached that the food remains in the mouth without effort and becomes practically tasteless. Thus the food, so to speak, swallows itself, and the person eats without thought either of swallowing or of not swallowing it ; swallowing is put into the same category of physiological functions as breathing, which ordinarily is involuntary.

2. *Following instinct.* Never to eat when not hungry, even if a meal (or more than one, for that matter) is skipped. And when a meal is taken, not to be guided by the quantity of food offered, or by past habit, or by any theories as to the amount of food needed. The natural taste or appetite is alone consulted, and the subject selects, from the food available, only those kinds and amounts which are actually craved by the appetite. After practice, the appetite gradually becomes more definite and discriminating in its indications.

These two rules — thorough mastication and implicit obedience to appetite — were alone employed during the ten weeks which constituted the first half of the experiment.

Shortly after the beginning of the second half of the experiment, there was an interim of six days at Easter recess, during which the few men who remained in New Haven took advantage of the temporary absence of the cook to try the possibilities of living without one entirely. During this brief period use was made not only of raw foods, such as fruits, nuts and milk, but also of foods which could be purchased already cooked, such as the flaked breakfast foods. But all the food was cold, and several of the men found it cheerless and unsatisfactory. Judging from their feelings, they were losing in weight and vigor. This part of the experiment was too brief, however, to justify any reliable conclusion as to the virtues of a raw, or rather a cookless, diet.

The second half of the experiment lasted about nine weeks. The same two rules which were employed during the first half were continued during the second, but a third rule was added. This was the use of suggestion, as follows :

3. *When instinct is in doubt, use reason.*—This rule consists of acquiring and applying a little knowledge of foods and food elements. For this purpose, in the present experiment two lists of food were given. One was arranged in a tentative order of intrinsic merit, beginning with fruits and ending with alcohol, and the other in

the order of the proportion of proteid. The men were then asked, when and only when the appetite was *entirely willing*, to choose the better and purer foods and the low proteid foods in preference to those high in proteid. In this way the men gradually shifted their diet upward in the two lists, and thereby pursued a little faster the same direction in which they had already been found to be unconsciously moving under the influence of thorough mastication and implicit obedience to appetite.

It would too greatly lengthen this report if any attempt were made to repeat in detail all the specific advice given to the experimenters under Rule 3. What has been said covers in a general way all the points except the advice (subject always to the consent of appetite) to eat light and quickly digested suppers in order to go to bed on an empty stomach.

Careful record of the amounts of food eaten and the constituents of proteids, fats and carbohydrates was kept for each man each day, certain days being omitted if for any reason the record was incomplete, as when, for instance, the men were out of town or took their meals away from the club.[1] To avoid weighing at the table, the food was all weighed in the kitchen and served in "standard portions" of 100 calories each, or simple fractions or multiples thereof, and the men merely recorded the number of portions eaten. The proportions of proteids, fats and carbohydrates were found by means of the writer's "Mechanical Diet Indicator."[2] Atwater and Bryant's tables were used as a basis for calculation. For the first few weeks the figures were probably subject to some errors, and in all cases more or less guessing had to be practiced with reference to the amount of lean and fat of meats; but the influence of any errors on the results must necessarily be small, because meat supplied, at the highest, only a small fraction of the total calories. It is believed that the results are in general correct to two significant figures.

For the first two weeks of the first half of the experiment, the men ate in their ordinary way. During the following eight weeks they masticated more thoroughly and followed the leadings of taste more carefully. Most persons, while nominally following taste, are largely

[1] The number of days each week on which the record of diet was kept was seldom under six.

[2] For a description of this instrument, see the writer's "A New Method of Indicating Food Values," *American Journal of Physiology*, April, 1906. For a description of its practical uses see "A Graphic Method in Practical Dietetics," *Jour. of the Amer. Med. Assoc.*, Apr. 20, 1907.

controlled in their selection of foods by many other circumstances,—as, *conventionality*, or the desire to eat what others eat and the unwillingness to appear "different"; *politeness*, the desire to please one's host and hostess; *food notions*, the opinion that certain foods and certain amounts of food are "wholesome" even if not palatable and that certain foods should be avoided as injurious even if delicious to the taste; *narrowness of choice*, as at a boarding house table, which often supplies what is not wanted and withholds what is; and *habit*, by which the particular kinds and amounts of foods which have become customary through the previous causes—conventionality, politeness, food notions, and narrowness of choice—are repeated day after day without thought. The subjects of the present study were given a wide range of choice, the menu including fruits, nuts, cereals, puddings and pastry, vegetables, milk, meats, etc. Meat if desired was available three times a day.

The object of the experiment was to find what effects on diet and endurance would follow from a strict obedience to the taste-instinct, when this instinct was given a longer chance to act by prolonged mastication and attentive tasting. Each man was therefore encouraged to choose his own food out of the menu for the day. Nothing was set before him until it was ordered, and even after a food was ordered it was not eaten if taste did not so dictate. The men were specially warned, during the first half of the experiment, against any conscious effort to decrease their food, proteid, or meat; and while it is possible that subconscious suggestion played a part, so far as could be observed they were freer from its influence than any ordinary experimenter who might take up the same experiment after reading Mr. Fletcher's or Professor Chittenden's books.

That this conclusion as to the relative absence of subconscious suggestion is correct was evidenced by the experiences both before and after this part of the experiment. For a month prior to its actual beginning (Jan. 14), the experiment had been fully decided upon, and its plan and scope understood by the men. Had subconscious suggestion played an important rôle, it would probably have shown itself in a reduction of proteid during this month; but determinations of the grams of nitrogen daily excreted in the urine, taken at the beginning and end of this month, indicated no substantial change, as the following table shows. (M. does not appear in this table, owing to the absence of any specimen for December.)

TABLE I.

	B	E	Lq	Lw	P	R	T	W	Average
Middle Dec.	11.2	11.1	13.8	12.3	11.3	13.9	14.2	15.9	13
Middle Jan.	10.4	12.7	14.3	14.3	11.1	14.8	12.2	15.4	13.1

On the other hand, during the second half of the experiment (Mar. 28–June 1), when the force of suggestion was consciously introduced, the reduction of flesh and proteid went on rapidly, as is seen in Table II. The facts, therefore, seem to show that the men followed directions closely, avoiding largely the influence of subconscious suggestion and following that of conscious suggestion in exact accordance with the directions given them.

Changes in Diet.

During the first two weeks of the first period when no change of habits was undertaken, the food showed little tendency to change in amount or in kinds. On the other hand, for the remaining eight weeks, during which thorough mastication and instinctive eating were practiced, there was a distinct though gradual tendency toward reduction in the amount of food, in the quantity of proteid, in the quantity of flesh foods, and in the quantity of liquids of all kinds—water, tea, coffee, cocoa, and even soups. Exact figures were kept for calories, proteid and flesh foods. These showed that the total calories gradually fell about 10%, the proteids, 15%, and the flesh foods, 40%.

In the second period, during which the force of suggestion to reduce proteid and flesh foods was added, the same effects were noted in a still greater degree. During this period the calories dropped nearly 20%, the proteid over 25%, and the flesh foods about 70%. Comparing the diet at the close of the entire five months of the experiment with the diet at its beginning, it was found that the total calories had fallen about 25%, the proteid about 40%, and the flesh foods over 80%, or to about one-sixth of their original amount. A part of the reduction, at least of the calories, is probably due to the change in season, as the experiment began in cold weather and closed in hot weather.

These results are shown in the following table :

TABLE II.

AVERAGE DIETETIC RECORDS OF ENTIRE CLUB

	Week	Average weight	Average no. of "portions" daily	Calories of proteid per lb. of body wt. [1]	Daily "portions" of flesh foods
1st Period	Jan. 17–23	149.8	28.3	2.7	2.4
	24–30		30.3	2.6	2.1
	31–Feb. 6		27.8	2.5	1.6
	Feb. 7–13		27.6	2.4	1.2
	14–20		25.8	2.1	.9
	21–27		26.4	2.2	1.1
	28–Mar. 6		25.3	2.2	1.2
	Mar. 7–13		24.6	2.1	1.3
	14–20		25.9	2.2	1.1
	21–27	148	26.7	2.2	1.4
2nd Period	28–Apr. 3		26.7	2.1	.8
	Apr. 4–10		25.7	1.9	.5
	11–17 [2]		27.3	1.7	.4
	20–26 [3]		26.1	1.7	.1
	27–May 3		25.5	1.9	.5
	May 4–10		25.7	1.9	.4
	11–17		26.2	1.9	.4
	18–24		24.9	1.7	.4
	25–31		22.2	1.4	.4
	June	144			

Remembering that a "portion" is 100 calories, we see that, during the first four weeks, the men consumed an average of from 2760 to 3030 calories per day, of which 120 to 240 were in the flesh foods, such as meats, poultry, fish and shell-fish, and that 2.4 to 2.7 calories of proteid were ingested for each pound of body-weight. Translating Professor Chittenden's figures for the physiological requirement of ingested proteid, we find it to be from 1.3 to 1.7 calories per pound of body-weight. Thus the men were at this time consuming nearly double the Chittenden allowance. During the last four weeks of the experiment all these magnitudes were lower. The per capita calories ranged from 2220 to 2620, of which only 40 were in flesh foods, and the proteid had fallen to 1.4 to 1.9 calories per pound of body-weight, which corresponds closely to the Chittenden standard.

Table II was constructed from the following three tables giving separate data for the individual experimenters.

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[1] This column is calculated throughout on the basis of the body-weights on Jan. 14.

[2] Except E., M. and P.

[3] Except E. The last two days of the Easter recess, Apr. 18, 19, are omitted in tables II, III, IV, V.

TABLE III.

DAILY QUANTITIES OF FOOD

(in "portions" of 100 calories each).

	Week	B	E	Lq	Lw	M	P	R	T	W	Average
1st Period	Jan. 19–23	25.4	26.1	22.4	32.6	23.9	27.0	32.0	36.1	29.4	28.3
	24–30	27.9	29.1	24.3	32.6	26.8	26.2	34.5	37.3	33.9	30.3
	31–Feb. 6	26.3	26.4	25.0	29.8	24.4	23.8	30.9	30.8	33.0	27.8
	Feb. 7–13	25.7	27.8	25.7	31.3	22.0	23.2	28.0	32.8	31.6	27.6
	14–20	24.0	32.4	24.0	26.1	21.6	20.3	25.1	29.2	29.4	25.8
	21–27	23.0	30.9	23.4	28.3	24.5	18.2	26.7	30.3	32.2	26.4
	28–Mar. 6	23.3	25.7	23.6	27.4	24.1	18.0	25.4	29.1	30.8	25.3
	Mar. 7–13	23.2	23.0	24.5	27.4	26.4	19.2	23.5	23.7	30.1	24.6
	14–20	21.9	21.6	24.5	29.1	30.2	20.8	25.0	30.8	28.9	25.9
	21–27	21.1	24.2	25.2	31.6	25.9	21.2	26.5	34.4	30.4	26.7
2nd Period	28–Apr. 3	22.6	26.3	26.2	27.5	25.2	23.0	26.1	33.5	30.2	26.7
	Apr. 4–10	24.2	24.2	24.6	27.7	22.5	22.5	26.2	30.5	28.7	25.7
	11–17	24.0	....	26.0	24.9	....	....	29.0	30.4	29.8	27.3[1]
	20–26	26.5	....	24.1	24.5	23.6	23.3	25.5	32.0	29.4	26.1[2]
	27–May 3	25.5	22.6	25.4	24.8	24.1	24.4	23.9	29.0	29.8	25.5
	May 4–10	23.0	25.5	26.5	24.4	27.1	23.1	26.0	28.7	26.7	25.7
	11–17	21.8	19.2	26.5	27.6	24.5	23.8	27.6	30.3	34.2	26.2
	18–24	22.7	19.1	23.7	27.8	19.5	25.4	24.6	26.5	35.2	24.9
	25–31	19.3	17.2	23.6	27.1	17.8	21.9	24.2	20.3	28.6	22.2

From this table we see that there were wide differences between the men in regard to the change in the quantity of food. During the first period the men who reduced their calories conspicuously were B., P. and R., the very men, as Table IX will show, who lost weight during this period.

During the second period, reductions were noticeable in E., Lw., M. and T. These, together with B. and P., were the men who lost weight during the second period. We see here a distinct correlation between quantity of food and loss of body-weight.

TABLE IV.

PROTEID (in calories) PER LB. OF BODY-WEIGHT

(Body-weight as taken Jan. 14, 1906)

	Week	B	E	Lq	Lw	M	P	R	T	W	Average
1st Period	Jan. 17–23	2.6	2.9	1.8	2.8	2.6	2.8	2.5	3.3	2.7	2.7
	24–30	2.5	2.8	2.2	2.8	2.7	2.5	2.5	3.0	2.8	2.6
	31–Feb. 6	2.2	3.1	2.4	2.9	2.5	2.0	2.3	2.7	2.6	2.5
	Feb. 7–13	2.1	2.9	2.2	2.6	2.0	2.1	2.0	2.9	2.6	2.4
	14–20	2.0	3.1	1.8	2.0	1.9	1.7	1.8	2.7	2.2	2.1
	21–27	1.8	3.2	1.9	2.3	2.0	1.5	1.9	2.8	2.4	2.2
	28–Mar. 6	1.8	3.0	1.8	2.3	2.4	1.5	1.8	2.6	2.4	2.2
	Mar. 7–13	1.9	2.5	2.0	2.3	2.5	1.7	1.7	2.1	2.6	2.1
	14–20	1.9	2.3	1.9	2.5	2.7	1.7	1.9	2.8	2.4	2.2
	21–27	1.6	2.6	2.0	2.7	2.4	1.7	1.9	2.7	2.2	2.2

[1] Not including E., M. and P.

[2] " " E.

TABLE IV—*Continued.*

PROTEID (in calories) PER LB. OF BODY-WEIGHT

(Body-weight as taken Jan. 14, 1906)

	Week	B	E	Lq	Lw	M	P	R	T	W	Average
2nd Period	Mar. 28–Apr. 3	1.8	2.6	2.0	2.2	2.2	1.9	1.8	2.7	2.2	2.1
	Apr. 4–10	1.5	2.9	1.7	2.0	1.7	1.5	1.8	2.4	1.8	1.9
	11–17	1.2	--	1.8	1.7	--	--	1.7	1.9	1.9	1.7
	20–26	1.8	--	1.6	1.6	1.7	1.5	1.5	2.3	1.6	1.7
	27–May 3	1.7	2.5	1.7	1.7	2.0	1.7	1.6	2.2	1.8	1.9
	May 4–10	1.6	3.0	1.9	1.9	2.2	1.4	1.8	2.1	1.5	1.9
	11–17	1.6	1.9	1.7	1.9	1.9	1.6	1.9	2.1	2.0	1.9
	18–24	1.5	1.8	1.4	1.7	1.8	1.6	1.6	1.7	2.1	1.7
	25–31	1.1	1.3	1.5	1.6	1.6	1.2	1.7	1.4	1.5	1.4

We observe from Table IV that the men who reduced their proteid the most during the first period were B., P., R., T. and W. Of these the first three only lost weight appreciably, and this was partly ascribable, as we have seen, to reduction in their calories. Careful examination of the figures would seem to show, however, that there is some correlation between reduction of proteid and loss of weight.

During the second period there was a decided reduction of proteid in all cases except that of R., who had already brought his proteid down considerably in the first period. E. reduced his proteid, but not until the last three weeks, when he seemed to try to make up for lost time. E., in fact, was the only man in the club, except possibly M. who (through mere inadvertence) did not follow out the rules of the experiment systematically. It need scarcely be said that this is not stated as censure ; for the very fact of the moderation of E.'s and M.'s mastication added to the value of the final comparisons. Even E.'s sudden reduction in proteid at the end was not maintained two weeks afterward, as was shown by the exeretion of nitrogen in June, given in Table VI.

It will be observed that the proteid at the end of the experiment was reduced to a fairly uniform level for all the men. Moreover, the proteid at the end corresponds closely with the results of Professor Chittenden's experiments. This is especially significant in view of the fact that this level was reached unconsciously—for only one of the men, Lq., who used the mechanical diet indicator for the entire club, knew regularly the exact character of each man's food proportions—and without any food prescription as was employed in the experiments of Professor Chittenden. This means that there is a simple way of reducing proteid to the level of "physiological econ-

omy," open to the ordinary man, without the necessity of special knowledge of foods and without the necessity of weighing and measuring food, either by the subject himself or by others.

Aside from the changes in proteid, the proportions of food elements did not vary greatly, the percentages of fat and carbohydrate in the total fuel value remaining very nearly constant. At the close of the experiment it was found that for all of the men the proteid in proportion to the total fuel value was very nearly 10%, having been reduced from about 14%. This reduction in the percentage of proteid was almost entirely offset by the increase in the percentage of fat, which rose from about 30% to about 33% on the average. The percentage of carbohydrate thus remained almost constant. Individual variations were much less than might have been expected. The proteid at the close of the experiment among the different subjects deviated very little from 10%; the proportion of fat varied from 28 to 36%, and the carbohydrate from 51 to 62%.

The results of the experiment may throw some light on the problem of the proper amount of food and food constituents for healthy men eating in a natural manner. For the five men, Lq., Lw., M., R. and W., whose weights showed least tendency to fall and whose average weight at the close of the experiment was 151.4, we find the average total calories were 2620, of which 10.7% was proteid, 33% fat, and 56.3% carbohydrate. The number of calories agrees closely with the estimates (for sedentary persons) of Atwater and Benedict by means of the calorimeter.

TABLE V.

QUANTITIES OF FLESH FOODS CONSUMED (meat, fish, shell-fish, poultry)

(In "portions" of 100 calories each).

	Week	B	E	Lq	Lw	M	P	R	T	W	Average
1st Period	Jan. 17–23	2.7	2.4	1.5	2.6	2.4	2.6	2.3	2.9	2.1	2.4
	24–30	2.2	2.2	1.7	2.0	1.8	2.2	2.1	2.1	2.2	2.1
	31–Feb. 6	1.3	1.9	1.2	2.1	1.6	1.3	2.1	1.9	1.4	1.6
	Feb. 7–13	1.3	1.6	.9	1.7	.6	1.2	1.5	1.8	1.2	1.2
	14–20	.9	2.3	.2	1.1	.7	.9	.9	1.6	.5	.9
	21–27	1.2	2.0	.2	1.6	.6	.7	1.6	2.1	.6	1.1
	28–Mar. 6	.8	2.1	.3	1.5	1.1	1.1	1.6	1.5	.8	1.2
	Mar. 7–13	.7	1.6	.1	2.4	1.0	1.2	1.9	1.6	.9	1.3
	14–20	1.0	1.7	.03	1.9	.9	.7	1.8	1.5	.7	1.1
	21–27	1.0	2.5	.0	2.5	1.7	.7	1.2	2.5	.6	1.4

TABLE V—*Continued.*

QUANTITIES OF FLESH FOODS CONSUMED (meat, fish, shell-fish, poultry)

(In "portions" of 100 calories each).

	Week	B	E	Lq	Lw	M	P	R	T	W	Aver.
2nd Period	Mar. 28–Apr. 3	.9	1.7	.0	1.7	.6	.8	1.1	.8	.1	.8
	Apr. 4–10	.4	1.1	.0	1.0	1.0	.1	.7	.8	.0	.5
	11–17	.1	--	.0	.9	--	--	.8	.7	.0	.4
	20–26	.0	--	.0	.1	.1	.0	.2	.4	.0	.1
	27–May 3	.16	1.2	.0	.6	.8	.2	.9	.5	.0	.5
	May 4–10	.0	.9	.0	.8	.8	.0	.5	.6	.0	.4
	11–17	.0	1.2	.0	.7	.8	.0	.4	.3	.0	.4
	18–24	.0	1.3	.0	.5	.5	.0	.8	.2	.0	.4
	25–31	.0	1.0	.0	1.0	.9	.0	.8	.4	.0	.4

Table V shows that during the first period all except E. and Lw. reduced their consumption of flesh foods considerably. It is noteworthy, as Tables XI–XIII will show, that these two were the men whose improvements in endurance were probably among the least during this period.

During the second period Lq., W., P. and B. virtually abandoned flesh foods entirely, the "portions" consumed daily averaging nearer zero than .1. These men improved greatly in endurance also. On the other hand, E., Lw., M. and R. reduced their flesh foods the least, and their ranking in respect to increased endurance was in general relatively low.

Excretions, Body-Weight, Strength.

The following table of nitrogen excreted in the urine is interesting in connection with the preceding table. It will be seen that the reduction in nitrogen daily excreted corresponds in general to the reduction in proteid consumed.

TABLE VI.

GRAMS OF NITROGEN EXCRETED DAILY.[1]

	B	E	Lq	Lw	M	P	R	T	W
Middle Jan.	10.4	12.7	14.3	14.3	8.7[2]	11.1	14.8	12.2	15.4
First April	6.6	14.7	9.2	11.1	---	6.3	11.6	12.4	9.0
Middle June	6.3	13.1	8.4	---	13.7	6.1	---	8.8	9.4
N. in middle June per kilog. of body-weight	.093	.22	.12	---	.21	.09	---	.12	.13

[1] Each figure is obtained by averaging 2 or 3 consecutive days' specimens.

[2] Jan. 23 and Feb. 10.

This table shows that all the men excepting E. and M. greatly reduced their nitrogen excretion during the experiment, and that at the close (with the two exceptions noted) the men were on about the same nitrogen level as the subjects of Professor Chittenden's experiment, namely, near one-tenth of a gram of nitrogen per kilogram of body-weight.

Through the kindness of Professor Benedict of Wesleyan University, nitrogen analyses were made in December, 1906, six months after the close of the experiment, to discover to what extent the men had adhered to their newly acquired diet after the eating club in which it had been practiced was disbanded. The results were B. 11.0, Lq. 10.5, Lw. 7.9, M. 9.9, P. 6.8, R. 11.5, T. 11.9, W. 8.9. These show that half of the men had reverted to some extent toward their original diets. The men state that the reason for this reversion was the difficulty in selecting food differing greatly in kind and amount from that customarily served at their boarding houses.

The following table shows that the volume of urine daily excreted was greatly reduced during the experiment :

TABLE VII.

VOLUME OF URINE DAILY EXCRETED (in cubic centimeters)

	B	E	Lq	Lw	M	P	R	T	W
Middle Jan.	1425	1160	1130	1391	817[1]	706	1287	1792	1177
First April	630	985	900	1252	....	629	1025	930	797
Middle June	802	1120	822	....	785	480	....	696	970

From this table we see a striking reduction in the volume of urine excreted, with the same two notable exceptions, E. and M. These two, who reduced their excretions least, were the men who were the least assiduous in observing the rules of the experiment.

A careful examination of the feces was made by Professor L. F. Rettger of the Sheffield Scientific School. A summary of his report follows. In it was included a comparative statement for three sets of specimens of two days each, taken in January, March and June, referred to below as series I, II and III. These included data as to the color, odor, quantity, consistency, approximate determination of the number and predominant kinds of bacteria, putrefactive and fermentative properties, and a true microscopic bacterial examination. In brief, to quote from Dr. Rettger's report and letter :

[1] Jan. 23 and Feb. 10.

"The odor was very slight in almost every specimen in the last series, a marked difference between these and series I and II, particularly I. The average weight is less than in both series I and II (av. wt. of series I = 137.3 grams; of II = 164.8 grams, and III = 120.4 grams).

"The figures indicate considerable difference in the putrefactive and fermentative properties of the three series, and the decrease is progressive. In series I the amount of proteid dissolved was much larger than in II and III. . . The specimens [of series III] were more solid generally than in both previous series. I was unable to note any appreciable difference in the microscopic appearance of the last series as compared with the previous, except that in specimen B of the last series a large number of moulds were present. This has little significance, however."

TABLE VIII. FECAL TESTS[1]

	Putrefactive Degree			Fermentative Property		
	Mid. Jan.	End March	Mid. June	Mid. Jan.	End March	Mid. June
B	?	?	8%	+ +	+	+
E	30%	25%	10%	+ +	+	+
M	20%	10%	15%	+	+	+
Lq	60%	?	50%	+ +	+	+
Lw	25%	15%	†	+ +	+	†
P	20%	?	?	+,	—	—
R	30%	20%	†	+ +	+	†
T	20%	?	5%	?	+	+
W	30%	10%	5%	+ +	+	+

We here observe that the degree of putrefaction in the last two tests was usually considerably less than its magnitude in the first test. The least change in the feces occurred in the cases of Lq., M. and E., and the greatest changes in P., T. and W. Here again we find some correspondence between the assiduity of the men and the observed physiological changes; for E. and M. were the least and P. and W. the most careful among the experimenters.

A critic has raised the question whether the improvement in the feces indicates lessened absorption of poisons, and whether, if the feces were longer retained, the improvement in their character might not be in consequence of the abstraction from them and absorption

[1] In the table, " + " signifies the presence and " — " the absence of fermentative property; " + + " represents a high degree of fermentative property; " ? " signifies that the putrefactive degree was doubtful, if not absent.

† No specimen.

into the system of a *larger* amount of poisons. The length of time of retention of the feces was not measured in any way. So far as can be guessed from the impressions of the men, it was not lengthened, certainly not greatly, as in the case of Mr. Fletcher.[1] As to the significance of the improvement in feces, Dr. Rettger writes :

"The subject of intestinal putrefaction is one of which very little is as yet known. A retention of feces may have the tendency of lowering the amount of putrefactive products. This is due, I believe, to two things : first, an absorption of such products as indol and mercaptan ; and second, an unusual amount of antagonistic action exerted on the evil-producing (putrefactive) bacteria by the ordinary and presumably helpful bacteria. Recent work seems strongly to emphasize the latter point. . . There is nothing to show that a small degree of retention would make a very great difference.

"The absence of appreciable amounts of putrefactive bodies from feces under the ordinary conditions of peristalsis does, beyond a doubt, indicate a lessened production of the products (toxines) ; the system must be the better off on account of this . . . the interpretation of the facts must be dealt with rather cautiously."

The following table shows the body-weights of the men (after deducting weight of clothing).

TABLE IX.

BODY-WEIGHTS IN POUNDS (without clothing)

	B	E	Lq	Lw	M	P	R	T	W	Average
Jan. 14	148	127	147	153	141	144	179	156	153	149.8
Mar. 28	144	128	147	154	142	136	176	155	151	148
June 16	138	122	146	149	138	131	175	148	149	144

We see that during the first period, the weights, except of P., remained practically stationary, but that in the second period all of the men lost somewhat in weight, though the loss was trifling in most cases. The only substantial losses during the two periods combined were : P. 13 lbs., B. 10 lbs., and T. 8 lbs. Of these it may be said that B. was distinctly over his normal weight at the start.

The distinct correlation between the loss of weight and the reduction in food, and to some extent in proteid, has already been noted. P.'s loss is ascribable largely to overstudy. The general slight reduction in weight of the entire club is probably explained in the same way, for all the men, with possibly two exceptions, distinctly overstrained

[1] See *The A. B.-Z. of our own Nutrition.*

in their college work. Besides the influence of overwork, there was also present the influence of the season,—at least if the common impression is correct that persons usually lose weight with the approach of warm weather.

Gymnasium tests were made at the beginning, middle and end of the experiment. These tests were of two kinds,—tests of strength and tests of endurance. The times of the tests were widely separated, partly because those of endurance were too exhausting to be often repeated, and partly because it was desired to avoid the influence of "practice"; for not only does practice increase strength and endurance, but it also gives the users of the strength-registering apparatus a facility or "knack" in manipulating it which produces a false appearance of improvement.

The dates of the three tests were January 14, a week after the end of the Christmas vacation; March 28, just before the Easter recess; and June 16,[1] just before the summer vacation.

Tests of strength, taken at the beginning, middle and end of the experiment, show the following effects:

TABLE X.

STRENGTH TESTS (in lbs.)

	Date	B	E	Lq	Lw	M	P	R	T	W	Average
R. Grip	Jan. 14	100	135	95	98	145	95	132	120	125	116
	Mch. 28	93	130	110	100	112	102	127	130	117	113
	Jun. 16	91	130	110	92	105	103	125	121	115	110
L. Grip	Jan. 14	94	115	82	112	107	82	131	95	127	105
	Mch. 28	82	115	110	100	105	70	115	106	111	102
	Jun. 16	75	115	97	105	105	70	125	98	110	100
Back Lift	Jan. 14	275	400	280	340	375	250	360	370	365	335
	Mch. 28	260	440	375	380	275	275	390	400	400	355
	Jun. 16	280	300	290	250	330	265	345	330	364	306
Leg Lift	Jan. 14	520	600	370	400	460	320	820	545	635	519
	Mch. 28	515	600	455	450	410	415	865	570	650	548
	Jun. 16	400	545	440	445	400	300	610	520	650	479
Total	Jan. 14	989	1250	827	950	1087	747	1443	1130	1252	1075
	Mch. 28	950	1285	1050	1030	902	862	1497	1206	1278	1118
	Jun. 16	846	1090	937	892	940	738	1205	1069	1239	995

In this table we see that during the first period there was a slight increase in strength (from an average "total" strength of 1076 to 1118), and during the second period a slight fall to 995, which is about 12% from the mid-year's 1118, and about 8% from the original

[1] But May 31 for E., Lw., R. and W., on account of earlier examinations than the others, necessity to leave town, etc.

1076. Thus the strength of the men remained nearly stationary throughout the experiment. The greatest losses were those of B., E. and R., whose records fell respectively from 989 to 846, 1250 to 1090, and 1443 to 1205.

The loss of strength, like the loss of weight, seems most probably explainable by the overstudy of the men. This cause was certainly actively at work, and would apply in the case of all of the club with possibly two exceptions. Overstudy applied conspicuously to B. and R., both of whom not only overworked during the entire period of the experiment, but had, just before coming to the last test, been through the most exhausting and sleep-robbing week of all. There seems, therefore, little reason to ascribe any part of the slight losses of strength to the dietetic experiment itself.

This opinion is confirmed by two facts : One is that the man who was least affected dietetically by the experiment was E., one of the three largest losers of strength, while the men who were most affected dietetically were P. and W., neither of whom lost strength perceptibly, in spite of P.'s severe overwork and loss of weight. The other fact is that in Professor Chittenden's experiment, which dietetically was very similar, the subjects, who were soldiers and athletes and not subject to pressure of work of any kind, showed large gains in strength. From these two facts we may infer that, so far as the diet is concerned, the effect would be to increase rather than to decrease strength.

Changes in Physical Endurance.

It is fortunate that the strength of the men remained so nearly stationary ; for it demonstrates the more clearly that the increase in endurance which will be shown below was an increase in endurance *per se*, and not in any degree due to an increase in strength. Strength and endurance are entirely distinct and should be separately measured. The strength of a muscle is measured by the utmost force which it can exert *once* ; its endurance, by the number of times it can repeat a given exertion *well within its strength.*

After much consideration and consultation it was decided not to place reliance on the ordinary ergographs as a means of measuring endurance.[1] Instead, seven simple gymnastic tests of physical endur-

[1] The reasons, in brief, were (1) because these ergographs are adapted to testing only a few unimportant, and for the most part unused, muscles ; (2) because, in operating these devices, the subjects do not simulate real work, since the mus-

ance were employed, and one of mental endurance. The seven physical tests were :

(1) Rising on the toes as many times as possible.
(2) Deep knee-bending, or squatting as far as possible and rising to the standing posture, repeating as often as possible.
(3) While lying on the back, raising the legs from the floor to a vertical position and lowering them again, repeating to the point of physical exhaustion.
(4) Raising a 5-lb. dumb-bell (with the triceps) in each hand from the shoulder up to the highest point above the head, repeating to the point of physical exhaustion.
(5) Holding the arms from the sides horizontally for as long a time as possible.
(6) Raising a dumb-bell (with the biceps) in one hand from a position in which the arm hangs down, up to the shoulder and lowering it again, repeating the motion to the point of physical exhaustion. This test was taken with four successive dumb-bells of decreasing weight, viz., 50, 25, 10 and 5 lbs. respectively.
(7) Running on the gymnasium track at a speed to suit the subject, to as great a distance as possible.

The mental test consisted of adding specified columns of figures as rapidly as possible, the object being to find out whether the rapidity of performing such work tended to improve during the experiment.

From the wisdom born of experience it may be stated that the physical tests were too numerous and too severe. But after they

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cles are placed in an awkward and unnatural position in which "no purchase" is felt ; (3) because experience has shown that subjects waste their effort by expending it not only while raising but while lowering the weight, and that this waste during the period of relaxation varies greatly with different subjects ; (4) because a fixed weight is used instead of a weight proportionate to the different strengths of the various subjects. One might as well attempt to test the walking powers of a woman weighing 100 lbs., as compared with those of a man weighing 200 lbs., by compelling the woman to carry a 100-lb. weight so that she might walk with the same weight as the man. Some of these objections have been met in special instruments, such as that of Prof. W. S. Hall of Northwestern University.

After the experiment was half over, and too late to make use of it, the writer devised an ergograph which, it is believed, meets all of the above objections. He was led to do so by the fact that the tests employed were so frightfully exhausting to the men. A description of the new ergograph will be published later. It is to be employed in further tests.

were once adopted in January, it was necessary in subsequent tests to adhere to them, so far at least as always to begin with the same test and follow the same sequence of tests as far as the series was repeated. It is clear that one's ability to succeed in an individual test would depend greatly on what and how many tests had immediately preceded; consequently the only modifications in the January tests which could legitimately be adopted in March consisted in omitting all tests after the first two or three. These first two or three, being taken under the same conditions as before, reflected correctly any change in endurance so far as those particular tests were concerned.

At the final series of tests in June, no omissions from the January program were made; to save time, however, the last two parts of test 6, together with test 7 (which came at the end for all the men), were repeated only up to the point at which they had been carried in January, although the men were able in June to carry them much further, and in many cases did so of their own accord. One man, for instance (W.), who in the run in January was glad to stop at 10 laps, went on in June to 34, running at the same speed until near the end; and this was done after having more than doubled his former records in almost all of the other tests. The unlooked-for increase in endurance made the June tests much more time-consuming than the tests in January and March. Had the men in June taken test 7, and the two last parts of test 6 up to the same fatigue limit as in January, some of them would have had to remain in the gymnasium (supperless) until bed time. One of the men, who in January in the last two parts of test 6 raised the 10-lb. dumb-bells 318 times and the 5-lb. dumb-bells 1,863 times, without doubt could have raised them in June double and probably treble these numbers, but to have done so would have consumed of itself an hour and a half of extra time.

In view, therefore, of the only partial repetition of test 7 and the last two parts of test 6, these records are omitted from Table XI. The first part of test 6 (lifting the 50-lb. dumb-bell) is also omitted, being given separately below.

The following table (XI) shows the results of the three sets of tests in January, March and June.[1] This table will repay careful study.

[1] The order in which the tests were taken was not the same for all of the nine men, owing to the lack of a sufficient number of gymnasium assistants in taking the tests. But care was taken that each man should himself preserve the same order in all three series of tests. Thus, for the March series he took the first two

From it we see that with one exception (E.) all of the men had improved in the March and June tests as compared with the January tests, and the eight men who did improve showed improvement in every test, except Lq., Lw. and T., who showed slight falling off in individual cases.

As inspection will show, some of the increases are remarkable. The recorded increases in the 60 odd cases were, with a few exceptions noted below, all true increases and not due to increased effort to break a previous record. In anticipation of such possible effect of ambition, the men were urged in the January tests to the utmost limit they could or would stand. The original intention had been to work each muscle tested until it was physically unable to repeat the motion, but this was not usually found practicable, except in tests 3, 4 and 6, and in some cases 2. In the other tests the will gave out before the muscles. The March and June tests were so managed that when a man had surpassed his January record he was not allowed to proceed beyond the degree of fatigue which he had reached in the first test. This was usually not a difficult matter, as the fatigue in January had been excessive and the men had no desire to suffer again the painful after-effects. Hence, with the exceptions to be noted, the March and June records not only exceeded those of January, but were accomplished with much less fatigue. The actual improvement was therefore greater than the recorded improvement.

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or three tests which he had taken in January. This explains why, in the March series, the tests as shown in the tables are not the same for all the men. The order of the January and June tests for the different men is given below. The tests which were taken in March are in italics.

B	*1*	2	3	4	5
E	*1*	2	3	4	5
Lq	*1*	*2*	*4*	3	5
Lw	*1*	*2*	*3*	4	5
M	*1*	*5*	2	3	4
P	*3*	1	5	2	4
R	*1*	2	3	4	5
T	*1*	2	3	4	5
W	*3*	*5*	1	2	4

TABLE XI.

TESTS OF PHYSICAL ENDURANCE.

			B	E	Lq	Lw	M	P	R	T	W
(1)	Rising on Toes	Jan.	300	1007	333[1]	69[1]	127	1482	702	900	1263
		Mar.	400[2]	1265[2]	2620[4]	65[1]	400[7]	....	831[2]	1500[4]	....
		June	500[2]	1061[7]	3000[5]	85[1]	1500[4]	1800[2]	1263[2]	1800[3]	3350[5]
(2)	Deep Knee Bending	Jan.	82	142	70	48	132	208	374	129	404
		Mar.	---	---	191[7]	47[7]	---	---	---	---	---
		June	200[2]	81[7]	202[2]	58[7]	155[2]	230[2]	453[7]	250[4]	508[4]
(3)	Leg Raising	Jan.	25[6]	52[6]	9[3]	22[6]	30[6]	27[6]	50[6]	23[6]	30[6]
		Mar.	---	---	---	33[6]	---	34[6]	---	---	40[6]
		June	33[6]	38[6]	20[6]	35[6]	31[6]	37[6]	103[6]	19[6]	53[6]
(4)	5-lb. Dumb-bell (triceps)	Jan.	75[6]	138[6]	78[6]	38[6]	51[6]	44[6]	100[6]	83[6]	185[6]
		Mar.	---	---	106[6]	---	---	---	---	---	---
		June	127[6]	59[6]	80[6]	51[6]	75[6]	56[6]	104[6]	101[6]	501[6]
			M S	M S	M S	M S	M S	M S	M S	M S	M S
(5)	Holding Arms Horizontal	Jan.	5- 0	1-33	4- 7	3-37	3-30	5-39	2- 5	3-22	11- 0
		Mar.	....	....	....	....	5-49	....	....	....	15-35
		June	9-36[6]	2-56[7]	3-50[7]	3- 0[7]	6- 5	10-1[2]	3-16[7]	3-24[7]	23-45[7]
(6)	25-lb. Dumb-bell (biceps)	Jan.	50[6]	18[6]	16[6]	6[6]	20[6]	11[6]	10[6]	25[6]	54[6]
		June	105[6]	10[6]	26[6]	33[6]	30[6]	29[6]	27[3]	75[3]	108[3]

Criticism of Records of Physical Endurance.

That the fatigue after the March and June tests was in general much less than after the January test was made evident by three substantial proofs. The first was the feelings of the men themselves as recorded in the foot-notes to Table XI. After the March and June tests, every man of the eight who showed improvement felt "not tired," or "less tired than in January test," which is the same as saying "not exhausted"; or else he had gone "to limit" as in January, which means that the muscle itself refused to continue work. The last was usually true of the "leg-raising," "raising 5-lb. dumb-bell (triceps)" and "raising 25-lb. dumb-bell (biceps)". The only tests in which there was the possibility of being mistaken as to the degree of fatigue were the "rising on toes" and "holding arms horizontal." In the former fatigue comes so slowly, and in the latter the pain is so intense that they prove to be tests of will power or "grit" quite as

[1] Cramped.

[2] Not as tired as in January test.

[3] Not to limit.

[4] Not nearly as tired as in January test.

[5] Not tired.

[6] To limit of muscle's capacity.

[7] About same fatigue as in January.

much as of muscle power. In these cases the men had some difficulty in remembering the original degree of fatigue. But the increases were so great and the men were so positive as to their feelings that there remains little room to doubt the substantial correctness of the results. In a few other individual cases, as of Lw. and Lq., whose records in test 1 were sometimes stopped by cramps, there is some room for doubt as to the correctness of the recorded improvement.

The second proof that the fatigue of the men in the June tests was less than that in the January tests was found in the fact that the stiffness and soreness which followed in June were markedly less than in January and of much shorter duration. This was true of all the eight men who showed improvement, except R.

The third proof of less fatigue in June than in January for the eight men is that in June the men finished the ordeal of the endurance tests with more strength left than in January, although, as we saw from Table X, they *began* the two tests with slightly less strength. The fact that they had more strength left after the June test is made evident by the first part of test 6, given below, which in each case came after the endurance tests were nearly or quite finished. This consisted in lifting a 50-lb. dumb-bell. The weight being so great, this was practically a test of strength rather than of endurance. Now all of the eight men who showed improvement in the *endurance* tests of Table XI, showed improvement in this *strength* test also, as the following table shows:

TABLE XII.

LIFTING (by biceps) 50-lb. DUMB-BELL. [1]

	B	E	Lq	Lw	M	P	R	T	W
Jan.	0[3]	1[3]	1[3]	0[3]	1[3]	0[3]	4[3]	2[3]	13[3]
June	1[3]	0[3]	5[3]	8[3]	13[3]	1[3]	10[3]	12[2]	26[3]

But, as we have seen in Table X, the strength tests taken *before* the endurance tests showed a slight falling off in June as compared with January for all but one (Lq.) of these eight men. In other words, in June the men *began* their endurance tests weaker than in January, but *finished* them stronger. The larger residuum of strength

[1] This part of test 6, being one of strength rather than of endurance, was not included in the endurance Table XI. Had it been included it would have increased even more the percentage of improvement shown, for it shows an average increase from 2.4 to 8.4, or 250%.

[2] Not to limit.

[3] To limit of muscle's capacity.

left after the June tests as compared with the January tests indicates that the June tests, in spite of being far more severe, fatigued the men less.

The 50-lb. dumb-bell test resolved the last doubts in my own mind whether, for some of the men, the recorded results might not exaggerate the true improvement. The two men of whose records I should have felt a little doubt were B. and R. Both of them came to the June test after prolonged mental exertion, and their exhaustion at the end was far more evident than that of any of the others. That it was great is clear from their own statements given below, though only R. reported himself as having been about as stiff and sore after the June as after the January tests. But both B. and R., whereas they had less strength (Table X) before the June endurance tests than before the January tests, had more strength left (Table XII) after the June tests than after the January tests. At the close of the January tests they were so exhausted that B. could not raise the 50-lb. dumb-bell at all and R. could raise it only 4 times. Had their exhaustion after the June tests been as great, it seems certain that B. would still have been unable to raise it, and R. would have been unable to raise it more than 4 times; but as it was, B. raised it once and R. 10 times.

The value of such a positive proof that the June tests were more easily endured than those of January was not perceived until the figures were analyzed. Had it occurred to me in time, all the strength tests taken before the endurance tests would have been repeated after them. It is true that the strength tests at the beginning were not of the same muscles as those (the biceps) used in the strength test by dumb-bells at the end, but, as Table X shows, the strengths of different muscles for the most part vary in unison with each other.[1]

It is significant that the only man whose strength, as shown by the above table, was less at the close of the June experiment than at the close of the January experiment was E., who was also the only man whose endurance showed any reduction. The facts, therefore, in his case are not discordant with those already stated; for, as has been stated, E. was the least assiduous in following the experiment. This was

[1] Out of the 108 comparisons of strength (i. e., comparisons for each of nine men in each of four tests for January vs. March, March vs. June, and January vs. June), only 20 are discordant with the general trend as shown by the totals. Thus, for B. the general trend between March and June as shown by the total was downward, and this downward trend is found in all but one of his four tests the discordant case being the "back lift."

often remarked, both to him and to me, by the other members of the club, and it was suggested more than once that I should "nudge" him. But, as I had been desiring a "control," or a subject in which all the conditions except mastication were the same as for the other men, I decided to say nothing. The result was instructive, for E.'s case stood out as exceptional in almost all respects. His reduction in quantity of food (Table III), except for a spurt at the end, was less than of most of the men; his reduction in proteid (Table IV), with the same exception, was the least of all; his reduction in quantity of flesh foods (Table V) was the least of all; his nitrogen in June (Table VI) was one of the highest; his reduction in volume of urine (Table VII) was one of the lowest two; his improvement in the fecal tests (Table VIII) was third to lowest; his loss of strength (Table X) was second greatest; and as to endurance, he was the only one who failed to show improvement.

There was only one other man, M., who was thought, though in a smaller degree, to masticate less carefully than the experiment called for; and for him we find corresponding peculiarities, though in a smaller degree. Thus, his reduction in total daily food (Table III) was less than of most of the men; his reduction in proteid (Table IV) was less than the average reduction; his reduction in flesh foods (Table V) was the third smallest; his June nitrogen was the highest (Table VI); his reduction in quantity of urine (Table VII) was one of the lowest two; his improvement in fecal test (Table VIII) was second to lowest; his loss of strength (Table X) was the third greatest (or fourth, if measured in percentage); and his increase in endurance, though great, was (except in test 1, which is subject to some doubt) less than the average.

The shortcomings of these two men, E. and M., as to mastication were not intentional, but due to carelessness and force of habit, as well as, in the case of M., to the fact that he waited on table and felt naturally more pressed for time. Their experience is valuable in showing that, in a general way, the changes in diet and endurance were proportionate to the thoroughness of mastication and the following of natural appetite.

The men kept diaries in which are recorded their sufferings after the various tests. These show a decided lessening in stiffness and soreness in the later tests, though in the June tests the men had generally done double the amount of work that they had done in January. It would have been a physical impossibility to do as much in January as was easily accomplished in June in tests 3, 4 and 6; and granted

that it had been even possible in January to goad the men to do as much in tests 1, 2 and 5 as they did without urging in June, they must certainly have been ill.

The following are statements from the men themselves :

Personal Impressions at end of Experiment.

(B) I was *very sore* [after the June test, Saturday, June 16, 1906]. However, I think the soreness was not so severe or lasting as it was after the January test. The muscles of my right arm were swollen considerably and I was unable to straighten it for two or three days. But the swelling was not so severe as it was after the earlier test and the arm was much more usable. The muscles of the thighs were the sorest ; they were nearly worn out. During Sunday, Monday and Tuesday after the test I had difficulty in walking ; and going down stairs was quite a difficult and severe undertaking. Wednesday morning the soreness had not left, though it had decreased considerably. I took a considerable tramp that day, and by night I could scarcely feel the soreness at all. By Thursday I had practically regained my normal endurance ; walked six or seven miles that day. The calf-muscles too were quite sore, but much less so than after the January test. There was another particular distinction. After the earlier test the calf-muscles were hard and knotted for several days ; but this time, while they were sore, they were almost normally soft. Saturday evening when I went to bed they were quite hard, but Sunday morning they were normal and practically remained so. . . .

I have no doubt that in my case there was great increase in endurance, though I think that I lost in amount of energy that I could exert at any given moment. This loss is due perhaps to two things ; (1) I took, on the whole, less exercise than during the time preceding the January test ; (2) I had been working quite hard for three months steadily, while the January test followed a three weeks' vacation during which I did little or nothing. As to increase of endurance there can be no doubt. For example, in the deep knee-bending, I began to get tired at 50 and had no idea of going above 100. When I reached this I set my goal at 125, then 150, 160, and was able to reach 200 before I was exhausted. In January, after I was tired I was not able to go on very long before I became completely exhausted. This shows increased endurance. I had the same experience in the other hard physical tests. In case of the run, I was sure I could not go more than three laps after my first lap ;

but I made 11 or 12 and could have gone several more. Considering everything, I have no doubt that I was able to hang on much longer, after I began to get tired, than in January.

I am at a loss to ascribe the increased endurance to anything else than to the diet. My way of living otherwise continued about the same after the January test as it was before. . . . Personally I am convinced that the increased endurance must be due to diet and manner of eating; all other factors that I can think of are unfavorable rather than favorable to more endurance. I am convinced to the extent that I shall certainly continue "Fletcherizing" and using a low-proteid diet.

(E) All effects of [June] test disappeared entirely within four days. [Effects of January test lasted six days.]

(Lq) The stiffness and soreness had entirely disappeared in four days. It was not nearly so severe as the test in January. After I was through in January I could hardly go down the stairs of the Gymnasium, and three days after the test going up and down stairs was accompanied with a great deal of pain. . . . I was stupid mentally for a whole week the first time, but in the last test I passed that stage in a couple of days. . . . Had it not been for the late hours and long stretches of work, I should have been able to make a better comparison with conditions in January, though as it was results show improvement. . . .

I cannot say as to the help mentally I have derived, for I have, always gone to my limit and I would be unwilling to make any positive statement. As for the physical, I know there is an improvement there, for my stomach, which was never so very strong, has been greatly helped.

(Lw) There was no stiffness or soreness felt in the triceps or the stomach muscles as the result of the last tests. The thigh muscles were a little stiff on the second day only—about such stiffness as one might expect from a long walk. The calves of my legs began to stiffen on Friday [June 15, 1906, the day after the test] and continued to do so on Saturday, after which the stiffening began to lessen, and was scarcely felt on Monday. The biceps of my right arm gave me the most trouble. These were sore on Friday A. M. and continued to increase in soreness till Sunday evening, feeling worst, however, Sunday A. M. When I arose Monday A. M. all the soreness and stiffness had disappeared. A peculiarity about the latter which impressed me was the fact that although my arm was very sore it did not seem to be very stiff. After the tests in January I could not

straighten my arm, but I could after the last tests in spite of the extreme soreness. I had entirely recovered by Monday from the tests. At no time after the tests did I feel any pain in proceeding up and down stairs, and if I remember rightly I couldn't say the same in January; neither did I feel particularly uncomfortable at any time. After the half-mile run and the lifting tests which I took later, I felt no soreness or stiffness afterward. . . .

I think the credit must be given to the diet experiment. I have worked harder from January to June than ever before, and have taken less exercise. As my mental work was so different from that previous, I cannot form an estimate of any increase or decrease in efficiency, but as I have said before, I always rested up more quickly. During the spring I have not felt that "all gone feeling" which usually has appeared in the past. The diet which we have had has relieved me of the sour stomach after meals, and I have felt better and worked harder on less exercise than ever before. . . . After a moderate amount of exercise, I have felt no such stiffness as used to come.

(M) The stiffness and soreness were entirely worn off in two days. I did not feel it nearly as much as I did last January. In fact, I did not exert myself to the utmost this last time because I had several examinations to take a day or two later.

My general impression is that the experiment was an all around benefit to me. I fully believe that during the tests, they reflected the true state of the case in showing my efficiency in June compared with that in January. I believe that there was a decided improvement in efficiency and could ascribe it partly to my exercise and the other part to the new manner of eating. I believe, however, that my exercise played a very small part because I think what I gained in exercise I lost in sickness [mumps].

My exercise this year was practically the same as years preceding. After April 1st I had very little exercise, on account of the mumps. This left me in a weak condition over a month. I had lots of work to make up and studied harder from April to June than any other period of my course. My exercise was neglected these three months and I studied almost constantly every day and until 12 at night.

My experience has shown me that I was at my best in mind and body when I ate meat four times a week. I have tried both more and less and found the above to be the medium. I also found that I could do more when I had the largest meal at noon. The greatest benefit of the experiment to me personally is that last year I broke down in the spring term and this spring I kept up my work and health in a much better condition.

(P) I went into the second test with some trepidation, knowing that I had lost considerable weight the preceding ten weeks. . . . Physically, I cannot say that I felt stronger before the second test than before the first; nor did I feel weaker. As the test developed, however, I soon saw that my endurance, both mental and physical, had increased.

Generally speaking, the soreness was less extensive, less trying or acute, and (I think) shorter-lived than in January. . . . It seems to me, as I finished the test much fresher than in January, a clear gain in efficiency is proven. The test seemed certainly to make a true report. . .

I can ascribe gain in endurance to nothing but the diet and thorough mastication. Every other factor in the situation was against this gain—exercise, of which I took certainly no more than usual and in the latter weeks much less; work, of which I had had a long, hard pull as against the three weeks' rest preceding the January test; sleep, much decreased for most of May and June. You stated last December that you wished every factor to be *in favor* of the first test and *against* the second. This condition has been true in high degree for my case. . . Whatever the efficacy of the two tests in proving the superiority of low proteid and thorough mastication for the other members of the club, I feel convinced that they prove that superiority with considerable force in my own case.

I have tried meat and chicken a number of times in the last two weeks, partly from curiosity and partly from necessity. But in every case anticipation has been pleasanter than realization, and my low-proteid tendencies bid fair to remain for some time to come. I may say that I had no opinion on the diet question when the experiment started, but am now a hearty low-proteid exponent. . .

I went into the test with considerable foreboding as to my endurance showing; for I have worked now without a break for twenty-two weeks at hard mental labor, the last two weeks being especially confining and involving large losses of sleep and exercise. I may say that I have been unusually well for six or eight weeks, and bowels have been running with greater ease and constancy than for several years. . . The endurance-tests, showing a good increase in every test, consequently came as a complete surprise; and my self-confidence, largely absent at the start, returned in increasing measure as the test went on. . .

Thursday, June 21 [5 days after test]. Played golf this morning and afternoon (9 holes each time) with perfect ease, no difficulty

with walking or driving the ball. Soreness wholly gone at present writing, no touch of it noticeable anywhere.

(R) The outcome of the last endurance test was about the same as the one held January 14, 1906. I was fearfully sore for about one week, reaching the climax at the middle of the week.

(T) Throughout the test I passed from one event to another with much shorter periods between than I did in January. With the exception of lying on my back and raising my feet, I at no time approached as near exhaustion as I did in January. In January, in rising on my toes and in the deep knee-bending, I continued till I fell to the floor. I was not exhausted at the close [of the June test], but marked papers for 2½ hours before going to bed. Sunday I scarcely felt any the worse, though my muscles felt a little queer when I poked my finger into them. Monday my leg muscles were a little stiff after a period of rest, but not painful in the least. My right shoulder was a trifle lame, due wholly I think to hitting it once in a while in the last test with the 10 and 5-lb. weights. My right arm at the elbow was decidedly lame and would not admit of being completely straightened, though it was undoubtedly better than in January. By Tuesday all the other stiffness had practically left me except the right elbow, which was, however, better. By Thursday I was unable to detect any soreness whatever in any part.

(W) May 31. After the test I felt fairly tired and ready to quit —however, not nearly so exhausted as before in January. Could walk down stairs with more confidence and could raise my supper to my mouth much more easily than after the first test. . . . The results certainly far surpassed any expectation I had, especially as in the morning I did not feel quite as spry and active as usual, due to a little unusual over-exertion the previous day.

June 1. Sore in thighs and biceps, also felt my abdominal muscles.

June 2. Expected to be much worse on this the second day, as in January, but not so. About same as yesterday. Later in the day could run up-stairs two steps at a time as I could yesterday—a thing undreamed of in January for over a week after the test.

June 3. Felt pretty well today, much improved over yesterday, still felt my thighs in walking down hill or down stairs, but not nearly as bad as yesterday.

June 4. Feel my thighs only very little, other muscles not felt at all. Rode a bicycle 5½ miles ; did not feel it.

June 5. Seem to be all well, haven't noticed a soreness all day.

The following table expresses the percentage of improvement in the records of Table XI.

TABLE XIII.

IMPROVEMENT IN PHYSICAL ENDURANCE IN PERCENTAGES.

		B	E	Lq	Lw	M	P	R	T	W
(1)	Jan.–Mar.	33+	26±	686–	–5±	215±	---	18+	66+	---
	Jan.–June	66+	5±	800–	23±	1081±	21+	79+	100+	165+
(2)	Jan.–Mar.	---	---	172±	–2±	---	---	---	---	---
	Jan.–June	144+	–43±	188+	21±	17+	10+	21±	94+	26+
(3)	Jan.–Mar.	---	---	---	50	---	26	---	---	33
	Jan.–June	32	–27	122–	59	·3	37	106	–17	77
(4)	Jan.–Mar.	---	---	36	---	---	---	---	---	---
	Jan.–June	69	–57	2	34	47	27	4	22	170
(5)	Jan.–Mar.	---	---	---	---	66±	---	---	---	42±
	Jan.–June	92–	89±	–7±	–17±	74±	77+	56±	1±	115±
(6)	Jan.–June	110	–44	62	450	50	163	170	200	100+
Av.	Jan.–Mar.	33+	26±	298±	14±	140±	26	18+	66+	37±
	Jan.–June	85±	–13±	194±	95±	212±	56+	73±	66±	109±

In the preceding table most of the figures are succeeded by a "+", which signifies that the true improvement was greater than the figures indicate. Thus, the first entry in Table XIII, "33+", means that B.'s improvement between January and March in test (1) (rising on toes) was *more* than 33%. Similarly, "686–" for Lq. in same test means that improvement was *less* than 686%. Again, "215±" for M.'s same test signifies that his improvement in this test may have been greater *or* less than 215%. Finally, when any figure is not followed by a sign, as for instance, B.'s (3) (leg raising), the meaning is that the figure given is, humanly speaking, correct. This accuracy applies only to those tests in which the muscles were worked till they were physically unable to repeat the movement. The reasons for the various suffixes may be found by studying the foot-notes of Table XI.[1]

[1] For instance the "+" after 33 for B.'s (1) is explained by the fact (as indicated in the foot-note to Table XI) that after his March test he was not as fatigued as after his January test, although he had improved upon his January record by 33%. The only cases in which the explanation of the suffixes will not be found from the foot-notes to Table XI are the following: E.'s (1), 26±, in which case the "—" is inserted owing to the fact that E. had come to the March test after the refreshment of a nap; and M.'s (1), 1081±, in which case the "—" is inserted owing to the fact that this high figure is inconsistent with the other results of the test, it being thought that M. may have been mistaken in his

The table shows enormous differences in the figures even of the same man for the same period. Thus, the June improvement of W. reads 165+, 26+, 77, 170, 115±, 100+. Such wide differences between the improvements in different tests seem puzzling at first, but they are explained, partly if not wholly, by two reasons. The first is the obvious one that many of the figures are not exact records, but understatements, and naturally their margin within the truth will vary widely. Thus, the records for deep knee-bending (2) for W. show merely that the improvement is *over* 26%; the true figure may well be 100%, which would be more consistent with the other figures. But the deep knee-bending test had been found in January very painful and inconvenient in its after-effects, and there was therefore less inclination in the June tests to approach closely to the limit in this particular test.

The other reason is that in some tests a larger fraction of the total strength of the muscle tested was called into play than in others. Thus, "leg raising" requires a very large fraction of the strength of the abdominal muscles, while "rising on toes" requires only a small fraction of the strength of the calf muscles. This may explain why, in general, the improvement in the test of the calf muscles seemed so much greater than in that of the abdominal muscles. This explanation is, however, purely hypothetical. It would be interesting to find out experimentally how much an improvement in the endurance of a muscle shows itself when it is exerted in different degrees, say to 75%, 50% and 25% of its strength-capacity.[1]

Bearing in mind these two possible reasons for the variations in the figures, and also the fact that there must have been more or less actual differences in the improvement of different muscles, we need not be surprised at the disparities which the table shows.

If we omit the cases in which the records are at all doubtful (with suffix ±) or exaggerated (suffix −), we have left the following table for the eight men who showed improvement :

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remembrance of his January test. The "−" has been inserted whenever there was the slightest ground of any kind for thinking the figures might be overstatements. With these figures weeded out, the remaining ones certainly understate the actual improvement.

[1] The original object of using the graded dumb-bells, 50-lb., 25-lb., 10-lb., and 5-lb., for testing the biceps, was to throw light on this problem ; but for reasons previously stated, these tests were not fully carried out.

TABLE XIV.

PERCENTAGE OF IMPROVEMENT (exact or understated) OF EIGHT MEN.

		B	Lq	Lw	M	P	R	T	W
(1)	Jan.–Mar.	33+	---	---	---	---	18+	66+	---
	Jan.–June	66+	---	---	---	21+	79+	100+	165+
(2)	Jan.–Mar.	---	---	---	---	---	---	---	---
	Jan.–June	144+	188+	---	17+	10+	---	94+	26+
(3)	Jan.–Mar.	---	---	50	---	26	---	---	33
	Jan.–June	32	---	59	3	37	106	-17	77
(4)	Jan.–Mar.	---	36	---	---	---	---	---	---
	Jan.–June	69	2	34	47	27	4	22	170
(5)	Jan.–Mar.	---	---	---	---	---	---	---	---
	Jan.–June	---	---	---	---	77+	---	---	---
(6)	Jan.–June	110	62	450	50	163	170	200	100+
Av.	Jan.–Mar.	33+	36	50	---	26	18+	66+	33
	Jan.–June	84+	84+	181	29+	56+	89+	80+	107+

The figures of Table XIV show an undoubted increase in endurance, both for the first half and more especially for the whole period of the experiment.

But, for an accurate presentation, we may carry our criticism one stage further. The figures given hitherto represent a conglomerate sort of endurance, made up of endurance of different muscles subject to different degrees of strain. As pointed out before, the calf muscles were called upon for only a small fraction of their strength-capacity, whereas the abdominal muscles were called upon for a very large fraction. Moreover, the fraction must have varied somewhat in different tests, according to the variation in strength and weight. An ideal test would be one in which the same fraction of strength was used. [1]

Fortunately, such an exact test is afforded by the 25-lb. dumb-bell. It followed immediately after the 50-lb. dumb-bell had been raised until the biceps was unable to repeat the motion. At the moment the 50-lb. test ended, the 25-lb. test began. At this moment the strength of the biceps was just at or barely below the fifty lbs. required to raise the heavier dumb-bell. In other words, in raising the 25-lb. dumb-bell the muscle needed *just fifty per cent.* of its strength at the time the test began. The use of the 25-lb. dumb-bell gradually reduced this strength from 50 to 25 lbs. The test was there-

[1] It is on this principle that the new ergograph, before referred to, is constructed.

fore perfectly uniform for all the men ; it showed how many contractions were necessary in each case to bring down the strength of the biceps from 50 to 25 ; it showed how much the muscle could endure before being robbed, by fatigue, of half its strength. Thus at the beginning the strength is 50 lbs.; after the first contraction it is, say, 49 ; after the second, 48, etc. But the contractions continue until the strength sinks below 25 lbs. The loss of strength may be said to measure fatigue. The *slowness* of this loss may be said to measure endurance and is well indicated by the number of contractions necessary to tire a muscle from a strength of 50 lbs. to a strength of 25 lbs.

Four exceptions, however, need to be noted. Three men, B., Lw. and P., were unable in January to raise the 50-lb. dumb-bell at all (see Table XII). Consequently their January test with the 25-lb. dumb-bell did not begin at 50% of the strength, but at a higher fraction. This explains their high apparent improvement. Thus, Lw. is credited with an improvement of 450%, because in January he could raise the 25-lb. dumb-bell only 6 times, and in June, 33 times. But the 33 contractions in June began at just 50% of the strength of the muscle, owing to its previous exhaustion to the 50-lb. level by the 50-lb. dumb-bell, whereas the six contractions in January began at a higher level; for at that time the biceps could not raise the 50-lb. dumb-bell at all. Its strength was at that time less than 50 lbs., say 40 lbs., in which case the lifting of the 25-lb. dumb-bell required not 50% but 62½% of its strength. To compare a 50% test of June with a 62½% test in January gives a record of improvement which is not one of pure endurance, but which includes the element of increased strength. This is "endurance" in the crude sense in which we may say a man has more endurance for carrying trunks than a boy ; but for a comparison of pure endurance, the boy should be given smaller trunks to handle than the man.

The fourth case is E., to whom the reverse reasoning applies. In June when he reached test 6, he was unable to raise the 50-lb. dumb-bell at all, though in January he had raised it once. Hence, while the 25-lb. dumb-bell was a 50% test in January, it was a more severe one in June, and the –44% which records his falling off does not represent a pure loss in endurance, but partly also a loss of strength. To reckon *pure* endurance we need to bring –44 up toward zero.

Making the four omissions just mentioned, we may use the remaining records from the last line of Table XIII, as a barometer of *pure* endurance.

We therefore have three methods of estimating the increase of endurance between January and June. These may be put together in the following table :

TABLE XV.

PERCENTAGE OF INCREASE OF ENDURANCE, JANUARY TO JUNE. BY THREE METHODS.

	B	E	Lq	Lw	M	P	R	T	W
Average 6 tests	85±	−13±	194±	95±	212±	56+	73±	66±	109±
Omitting doubtful cases "+"	84+	---	84+	181	29+	56+	89+	80+	107+
"Pure" endurance of biceps	---	---	62	---	50	---	170	200	100+

The first line of this table tells us the average of the recorded improvement in endurance shown for each man. But as each such average is made up from the figures of Table XIII, some of which, as indicated in that table, are possibly too high, some doubt necessarily attaches to it, though practically the only real cases of doubt are Lq. and M. The average of these averages is 101% for the entire club, and is probably within the truth ; for most of the individual figures which go to make up this result are understatements, not overstatements.

The second line shows the average improvement in tests in which there is no doubt that the figure is at least not too high, though it may be too low. The average of these is 89%, and is therefore certainly too low an estimate of the average improvement for the eight men who improved at all.

The third line shows the increase of *pure* endurance (that is, endurance considered apart from strength) for the five men for whom the figures were available. The average of these is 116%.

We are quite safe in saying therefore that the average improvement of the eight men who improved was 90%. As to the degree of retrogression of E., it is difficult to say, though it is believed that the figures exaggerate it. This is certainly true of the 25-lb. dumb-bell test, for reasons given. My own impression, and E.'s also, is that he actually gained in endurance from the dietetic experiment, but that his gain was not enough to offset the loss occasioned by (1) the hard term's work, which, as in the case of the other men, was a decided handicap, and (2) the omission of his customary exercises, which must have

been a greater handicap in his case than in any other of the men ; for he had been accustomed for six years to heavy gymnasium training, but during the year of the experiment this training was given up, largely because of the difficulty in finding time for it. If this interpretation is correct, we may liken the experiment to nine men trying to swim against a current. The eight who exerted themselves the most succeeded in forging ahead; the one who tried the least drifted backward, though the effect of the swimming (dieting) was to propel him forward. Whether or not E. was actually propelled forward by diet must remain a matter of conjecture or inference ; but that the other eight men gained is an established fact.

Changes in Mental Endurance.

The mental test consisted in adding a specified number of figures. The following tables show the time during which the addition was performed and the number of errors committed :

TABLE XVI.

TIME OF PERFORMING A UNIFORM AMOUNT OF ADDITION.

		B		E		Lq		Lw		M		P		R		T		W		Average	
		M	S	M	S	M	S	M	S	M	S	M	S	M	S	M	S	M	S	M	S
Time of adding	Jan. 14	5	40	4	49	6	15	4	54	6	46	3	1	7	6	6	41	4	6	5	29
	Mar. 28	5	16	4	27	4	35	4	15	5	47	2	43	6	32	7	18	4	34	5	3
	[1] June 16	4	50	5	9	4	40	4	23	5	50	2	58	7	3	6	5	4	7	5	0

This shows that during the first period seven had improved and two had fallen off, and on an average there had been a decrease from 5m. 29s. to 5m. 3s., an average improvement of 26s. W. showed an increase in time of adding, although he would naturally have been expected to improve on account of having taken up clerical work involving adding.

During the second period there was an average improvement of only 3s. ; three retrogressed 15s. to 42s., three retrogressed 3s. to 8s., and three improved 26s. to 73s. The fact that the men held their own in the June adding test is probably indicative of actual improvement, for they were fatigued mentally by examinations, etc., on the day when they entered the June test. During the entire experiment there was an average improvement of 29s. ; seven had improved and two had retrogressed (1s. and 20s.)

[1] E., Lw., R. and W. taken on May 31.

The following table shows that the number of errors committed was remarkably constant for most of the men and for the average :

TABLE XVII.

NUMBER OF ERRORS OF ADDITION.

		B	E	Lq	Lw	M	P	R	T	W	Average
Errors	Jan. 14	10	8	12	4	1	1	2	1	1	4.4
	Mar. 28	16	5	8	4	3	0	3	2	1	4.6
	June 16	8	13	5	4	2	1	6	0	2	4.5

The adding test was too short to be of great value. In future tests a larger number of figures will be employed, and a different method. After the specified amount of adding has been done, it will be at once repeated on another equivalent set of examples. The excess of time required for the second set over that required for the first may be called the "fatigue time," and this fatigue time, taken as a percentage of the total time of adding, may be used as a criterion of endurance—the less it is, the greater the endurance, and *vice versa*. This plan was developed too late to be put into operation at the beginning of the experiment. It was, however, employed in the March and June tests, and confirmed the conclusion reached above, that there was little difference between the mental endurance in March and June. Five of the men showed a less "fatigue time" in June than in March, and four a greater.

The following statements of the men themselves will show that their feelings as to working power were in harmony with the conclusion that it had improved :

Subjective Impressions as to Mental Working Power.

B. (March) "Not decreased at any rate, seems to have increased."
(June) I did more work during the latter part of year than I ever did before in an equal period of time. But, I had the work to do and compelled myself to do it. However, I was mentally tired at the close of the year, particularly so at the time of the test, for it came after the siege of exams for which I did my own work besides a couple of days of hard tutoring.

This much, at any rate, is positive : There was no decrease of mental power resulting from the experiment. I was no more tired at the close of last year than I was at the close of the year before. After a week's rest I felt quite normal and then did considerable mental work all summer.

E. (March) "Working power improved. Can concentrate attention for a longer time."

(June) "I accomplished a greater amount of mental work than in previous years during the corresponding period of the college year. I do not think that my feeling of fitness for it was any greater, however, and I cannot say that my experience of fatigue after the work was any less. I learned to eat slower than had been my custom during previous years. Though not subject to indigestion, I experienced less stomach disorders during the period of the experiment."

Lq. (March) "I have put in more long hours during this term than any previous term, consequently have had a good deal less sleep. I do not know that I can work any better, except that I can work a longer period at one time without feeling so tired from it."

(June) "Of course a great deal of the extra work was outside work which was an extra tax. I, however, did a great deal more work on papers that I prepared than I ever had before. . . . Although I spent longer hours than before I did not feel the effect of the work so much as before."

Lw. (March) "Have been working harder during the past four months and have taken less exercise than at any other equal period during past $2\frac{1}{2}$ years. The character of the work has been so different that I am unable to say whether there is any increase in working power, but I find that I rest up very quickly after becoming tired (mentally).

"When March tests were taken I did not feel as 'fit' for test on that particular day as at time of January tests. Had been working hard and had been under nervous strain, which undoubtedly affected the tests."

(June) "I have worked harder from January to June than ever before, and have taken less exercise. As my mental work was so different from that previous, I cannot form an estimate of any increase or decrease in efficiency, but as I have said before, I always rested up more quickly."

M. (March) "I think on the whole a slight improvement."

(June) "Do not notice any change."

P. (March) "I have never worked so steadily, or with so little necessity to exercise the will to work, as in the central six weeks of the test. The work I was doing was chiefly research in the Library, poring for three or four hours at a time over old records—not labor of the most interesting kind."

(June) My work from March to June was of a more confining sort than ever before in the spring. From March to the Easter recess I was occupied with library research ; from Easter on I was engaged on an essay and the marking of some 260 Social Conditions theses. On these last I spent considerably more time and effort than in the preceding year. Thus my work was harder and more time-filling than usual. I had much less out-door exercise than in previous springs, and missed that relaxation from effort which all prior springtimes have bred. Yet there was no feeling of overwork, or even of work as a burden, till the first of June. From then on I did feel tired, and examination time found me with a mind very difficult to keep in harness. Undoubtedly I had over-pushed myself, but did not realize it till June. . .

R. (March) Felt an increase in efficiency.

(June) My power for mental work was greater between the March and June tests than between the January and March tests and the latter was greater than before the experiment began in January. I can state without hesitation that my mental working power increased in consequence of "Fletcherizing."

T. (March) Felt that he had at least held his own, but "surprised to find that every one of my tests (physical) had improved." For the first test came after the rest and recreation of the winter holidays when he "was in splendid condition. Since then I have had to work extremely hard with little regular exercise and rarely in bed before about midnight." Surprised also that the mental test showed no improvement, probably because "the confusion around me was considerably greater than in the first test." Can do his ordinary mental work faster than before, though not sure that he can work longer.

(June) "I consider I did more work last year during the period of the experiment than any other year. During the whole nine months of the college year I was practically working up to my limit of endurance. I did not grow sleepy as early evenings as previous years and my attention was not as easily distracted from my work as previous years.

"The lack of improvement in the second mental test may have been due largely to the fact that I was mentally fagged out after the examinations and was feeling the need of my holidays."

W. (March) No definite impression either of gain or loss.
(June) "On the whole I felt quite as workish as ever I did in the spring months and did not feel the hot days as much of a drag as usual."

As to illness, in the course of the experiment there were the usual winter colds, though apparently these were less common than before. One man had grip for a few days, another the mumps, and several had constipation. In general, the men expressed themselves as better than usual and in some cases they were very enthusiastic. None of the ailments suffered by the men were ascribable to the test itself, unless it be a case of what appeared to be slight rheumatic sensations of T., who had always been a heavy meat-eater, and who during the experiment introduced at first much acid fruit. That the acid in conjunction with the high proteid might occasion such symptoms is at least consistent with some of the numerous theories of rheumatism. On avoiding very acid fruits he soon lost all these symptoms.

The following extract from the diary of B. is, I think, typical of the facts in this respect to general health: "Have now, March 23, slight sore throat. In regard to colds, I have been troubled less this year than at any time for years; but this fact may be due to great change in climate, Nebraska to Connecticut. Have usually had colds more or less all winter; therefore my freedom has been indeed remarkable. From September last till the beginning of the experiment I experienced frequent attacks of indigestion, 'heart-burn.' Have been almost free from that, though two or three times I had the same experience after eating bananas."

Summary.

The phenomena observed during the experiment may be summarized as a slight reduction of total food consumed, a large reduction of the proteid element, especially for flesh foods, a lessened excretion of nitrogen, a reduction in the odor, putrefaction, fermentation and quantity of the feces, a slight loss of weight, a slight loss of strength, an enormous increase of physical endurance, a slight increase in mental quickness. These phenomena varied somewhat with different individuals, the variations corresponding in general to the varying degree in which the men adhered to the rules of the experiment.

That we are correct in ascribing the results, especially in endurance, to dietetic causes alone, cannot reasonably be doubted when it is considered that no other factors of known significance were allowed

to aid in this result. On the contrary, so far as the operation of other factors was concerned, these must have worked against rather than for the results achieved. Exercise was in no case indulged in to a greater extent than had previously been the custom, and in most cases it was less. The men were warned not to take up exercise, except so far as they had been accustomed to before the experiment began, and if they varied their exercise at all, to lessen rather than increase it. They were very conscientious on this point, as on others, —so much so that some of them at first gave up exercising until they began to feel "logy." This over-zeal was corrected ; but in no case have I reason to think that the exercise taken was more, or more systematic, than previously. M. was probably the most systematic in taking exercise. His statement on this point, as previously given, the reader may care to review.

The men did not practice on the endurance tests between times. This was expressly forbidden, and the men were too trustworthy to admit of a doubt on this point. The tests themselves, needless to say, were too far apart to have given any chance for repetition to give "knack," and were too severe to count as beneficial exercise.

Nor were the men more regular in their hours of retiring or other habits. On the contrary, they were rather more reckless in burning the midnight oil. It developed that, with their increased freedom from fatigue, they indulged more freely than ever their propensity to work in the lines of their respective ambitions. At first they felt justified in doing this, as it accorded with their instructions not to remove any handicaps to their chance of improving their endurance, but to increase rather than decrease such handicaps. But this liberty became license, and I was forced to remonstrate with the men for their late hours and overstudy, which tended to rob them of their surplus endurance almost as fast as it accrued. Long before the experiment was finished the men had given every appearance of improved working power, but I was not at all sure that they would have any of it left to show in the final test, because of their tendency to use it up in work. Had the extent of their working proclivities been realized in advance, it is doubtful if the experiment would have been undertaken at all. It should be stated that all except M. were graduate students, and almost all of them, in addition to their university work, were earning their own way.

The advance of warm weather must have tended, had not their diet counteracted it, to tire the men, if, at least, we may trust common impressions as to "spring lassitude."

Again, the conditions immediately preceding the March and June tests, as compared with those preceding the January test, were such as to give the advantage to the January test. The latter came soon after the Christmas holidays, when the men, as they themselves stated, felt refreshed and at their best, whereas the March test came just before the Easter recess, after a hard term's work, and the June tests came after a like period of hard work,—in some cases, as of B. and R., immediately after exhausting examinations.

Finally, the tests themselves were serious drains on vitality. Each required a period of from several days to two weeks for recuperation, and each robbed the men temporarily of several pounds of weight. The cookless diet experiment for six days also cost something to those who took part in it.

In addition to the tests mentioned in this report was one on January 23 of leg-raising, deep knee-bending and arm-stretching, taken after a night from which two hours of sleep were purposely cut off. After consideration, it was decided not to repeat this test as being too fatiguing. It therefore has been omitted from this report; but it added one more burden for the men.

When, therefore, we observe the known handicaps,—the over-study, the strain of the tests, the advance of warm weather, the fact that the first test came after rest and the other tests after work, and when we are unable to find any other cause than diet—such as exercise, regularity of bed-time or other habits—we are forced to conclude that the only causes which produced the endurance were dietetic.

Possibly some persons may be disposed to find a convenient escape from this conclusion by ascribing the improvement to suggestion. Under this theory, the men improved because they expected to. It is quite true that there may be more force in autosuggestion than most of us realize. But, fortunately, for the present case we scarcely need to argue the point; for as a matter of fact it was not true that all of the men expected to improve. This was certainly not true before the March test. In fact, the men were about equally divided in their predictions as to the outcome, and used to have animated discussions. Yet, both the confident and the skeptic faction improved in endurance in the March test; and so far as I am acquainted with their prognostications and have noted their improvement, there was little if any correlation between those prognostications and their improvement.

It is of course still *possible* that some unobserved element has crept

into the case, to which, and not to the diet, the improvement in endurance was due; but in view of all the facts recited, this is extremely *improbable*. What slight doubt remains should be resolved by further studies. I earnestly hope that other and more careful studies may be made by more competent investigators than I.

We conclude that the improvement in endurance was exclusively due to dietetic causes. The only dietetic causes at work were (1) thorough mastication, (2) implicit obedience to appetite, (3) (during the second half of the experiment) when appetite did not clearly determine the choice, the voluntary selection of the non-flesh and low-proteid foods, and (4) an ample variety of good foods, well cooked.

So far as cooking is concerned, this cause, as has been said, entered unintentionally. But there is no evidence that it was a prime factor in the experiment, while there is some evidence to the contrary. Thus, E., who especially remarked the culinary virtues of the cook and who missed her services more than any one else during the brief period of her absence, was the one member of the club who failed to improve in endurance.

If we allow ourselves to speculate as to the changes in the character of diet which were produced by thorough mastication, we may draw an inference from the fact that the carnivorous animals are fast-eaters, whereas the grain-eating animals are slow-eaters. It would seem, therefore, when man changes his habits from fast eating to slow eating he naturally changes his food from the food of a fast-eating to that of a slow-eating animal. The question, therefore, which is the natural food for man, may possibly be associated with the question, which of the two methods of eating is natural to man. Was the slow eating of the nine men an artificial and unnatural practice, as would be indicated from the fact that the majority of men eat far faster? Or, are the ordinary habits of man in respect to the manner of fast eating themselves unnatural? I have not attempted to gather the facts necessary to solve this problem, but it certainly constitutes an interesting one for the physiologist and anthropologist. The few facts upon which I have chanced to fall would seem to indicate that man is naturally a slow eater, and that the hurry-habit to which most of us are prone is a consequence of the artificial high-pressure to which modern civilization has subjected us. Certain it is that the conditions which give rise to quick-lunch counters and to the short stops of trains for refreshments, were produced, not in order to meet any natural propensity to eat fast, but on the contrary, in the

interest of the more rapid transaction of business, with which meal-times are regarded as an interference.

We may therefore at least conclude that whatever the speed of eating which is natural to the human animal, his actual speed under civilized conditions is greater than natural. It is noteworthy also that children are very deliberate in eating their cookies. It is only after they are reproved for keeping their elders waiting that they begin to imitate the latter and bolt their food. Dr. Higgins [1] and Dr. Hasse [2] have pointed out also some physiological considerations, based on the anatomy of the human throat compared with the throats of the carnivores and of "poltophagic" animals, which would indicate that man, to a large extent at least, is naturally a slow-eating animal. Dr. Henry Campbell [3] has also given some evidence, based on a study of the primitive tribes, to show that chewing is more thorough among uncivilized races, and that the hurry habit to which we are accustomed is largely promoted by the use of prepared and 'mushy" foods,—which, in fact, appear to have been devised expressly for the purpose of being quickly swallowed.

The evidence, however, on the natural food-habits of man is as yet very meager, and it is only provisionally that we may consider the thorough mastication advocated by Mr. Fletcher as "natural." With this reservation we may say that the experiment here described may be called an experiment in natural eating, or an effort to restore a blunted or lost food-instinct, so that it may serve as a safe guide to the proper quantities and kinds of foods. If it be asked in what way this natural eating tended to improve endurance, whether it was because of the finer sub-division of food through mastication; the increased "insalivation"; the increased flow of "appetite juice"; the better adaptation of foods to the particular needs of the individual and the moment; the lessened quantity of food; the lessened proteid; or the lessened amount of flesh foods, no satisfactory answer can be given, although, as the previous discussion shows, there is more or less evidence on some of these points. There are certainly some very fascinating problems for the physiologist to solve in regard to fatigue as related to diet. Are the "fatigue poisons" due, for instance, chiefly to the combustion of proteid in excess of the physiological

[1] See *Humaniculture*, N. Y. Stokes, 1904.

[2] See Archiv für Anatomie (Waldeyer's) 1905, p. 321.

[3] "Observations on Mastication," London *Lancet*, July 11, 18, 25 and Aug. 8, 1903. Reprinted in Horace Fletcher's *The A. B.-Z. of Our Own Nutrition*, Stokes, 1903. See pp. 126–135.

needs, as the theory of Chittenden would explain them? Or, are they largely due to the ingestion of these poisons with flesh foods, as the vegetarians and Dr. Haig have maintained? Or, do both explanations have a share?

The results of the experiment demonstrated so great an increase of endurance as to seem at first incredible. It certainly was a surprise, both to the men and to me. But statistics which I have been collecting during the last two years have prepared me to find great differences and changes in endurance. The special result of the present experiment is to show that diet is an important factor in producing such alterations. The fact that endurance, even among persons free from disease, is one of the most variable of human faculties—far more variable than strength, for instance—is evident to any one who has made even a superficial examination. Some persons are tired by climbing a flight of stairs, whereas the Swiss guides, throughout the summer season, day after day spend the entire time in climbing the Matterhorn and other peaks; some persons are "winded" by running a block for a street car, whereas a Chinese coolie will run for hours on end; in mental work, some persons are unable to apply themselves more than an hour at a time, whereas others, like Humboldt, can work almost continuously through eighteen hours of the day. Among statistics gathered independently of the present experiment, I have found measurable differences between persons far greater than the change of endurance of the eight students which we have seen.[1] Among some 50 tests of different persons holding their arms horizontally, many were found whose arms actually dropped against their will inside of ten minutes, whereas several were able to hold them up over an hour, and one man held them 3 hours and 20 minutes, or a round 200 minutes, and then dropped them voluntarily. Similarly with deep knee-bending, some persons were found physically unable to rise again from the stooping posture after accomplishing less than 500 bendings, whereas several succeeded in stooping 1,000 times, and in one case, 2,400. Again, in leg-raising, the legs positively refused to rise to the vertical in some cases before 40 times were reached, whereas in two cases this motion was performed 1,000 times or over. On the new ergograph previously referred to, among the 16 preliminary tests there was a range in endurance between different persons from 18 to 145 and in the same person at different times from 29 to 110.

[1] For an account of some of these statistics see "The influence of flesh-eating on endurance." *Yale Medical Journal*, March, 1907.

It is, to say the least, remarkable that hitherto so little effort has been directed toward discovering the factors which explain such differences in endurance. That exercise is one of the most and perhaps the most important factor has alone been recognized. A correspondent assures me that by means of moderate *regular* exercise he succeeded in increasing his endurance between 100 and 200% in three weeks as measured by leg-raising and "dipping." The influence of diet has always been regarded as small or negligible, and the opinion has been almost universal, until recently, that a diet rich in proteid promotes endurance. Even among those whose researches have led them to the opposite conclusion, there is very little conception of the extent to which diet is correlated with endurance. Such a person, a medical friend of the writer, stated, when the present experiment was planned, that he did not think the dietetic factor strong enough compared with others to produce any marked effect. We have all heard, of course, of the enthusiastic reports of vegetarians as to their increased endurance, but these we have discounted as exaggerations. The result of the present experiment, however, would seem to indicate that one's improvement in endurance is usually not less, but greater, than he himself is aware of. Probably it is also true that we may lose a large fraction of our working power before we are distinctly conscious of the fact.

While the results of the present experiment lean toward "vegetarianism," they are only incidentally related to that propaganda. Meat was by no means excluded; on the contrary, the subjects were urged to eat it if their appetite distinctly preferred it to other foods.

The sudden and complete exclusion of meat is not always desirable, unless more skill and knowledge in food matters are employed than most persons possess. On the contrary, disaster has repeatedly overtaken many who have made this attempt. Pawlow has shown that meat is one of the most and perhaps the most "peptogenic" of foods. Whether the stimulus it gives to the stomach is natural, or in the nature of an improper goad or whip, certain it is that stomachs which are accustomed to this daily whip have failed, for a time at least, to act when it was withdrawn.

Nor is it necessary that meat should be permanently abjured, even when it ceases to become a daily necessity. The safer course, at least, is to indulge the craving whenever one is "meat hungry," even if, as in many cases, this be not oftener than once in several months. The rule of selection employed in the experiment was merely to *give the benefit of the doubt* to the non-flesh food; but even a *slight* preference for flesh foods was to be followed.

Under flesh foods are included all meat- and "stock-" soups. It has been shown that although these extracts of meat contain a large amount of nitrogen, it is not in the form of proteid which can be utilized, but only of waste nitrogen which must be excreted. Apparently the sole virtue of such soups is that they supply the "peptogenic" stimulus above referred to.

The experiment will be seen to harmonize with and supplement the experiment of Professor Chittenden, on which it was founded; but the objects of the two experiments were quite different. Professor Chittenden's was aimed to ascertain the physiological requirements as to proteid, and did not touch upon the question of endurance. Moreover, Professor Chittenden, in order the better to measure the proteid and nitrogen, artificially reduced the quantities ingested, whereas in the present experiment, test was made of Mr. Fletcher's claim, that thorough mastication leads naturally to the adoption of the physiological amount of proteid. This we found to be true, especially after the introduction, at the middle of the test, of the suggestion that when appetite was in doubt, the lower proteid foods should be selected. But the tendency was quite marked during the first period also, and might have been expected to lead to the same results without the introduction of even the suggestion of voluntary choice, had the experiment been long enough. This was the experience of others, notably Mr. Fletcher himself, whose case, in fact, first called Professor Chittenden's attention to the possible virtues of low proteid.

The practical value of the experiment consists in the fact that any layman can apply it, with or without a knowledge of food values, though with more advantage if he possesses than if he lacks such knowledge.

If the dietetic rules of the present experiment are followed, no self-denial as to foods is required. It is, however, absolutely necessary that there should be *self-control* enough to break up the habit of hurried eating to which modern civilization has brought us, habituating us, as it does, to eat against time.

Experience indicates that appetite does not lead to a diet fixed in amount or constituents, but moves in undulating waves or cycles. The men who took part in the experiment were encouraged, after any of the symptoms which seemed to be associated with high proteid (such as heaviness, sleepiness, stiffness or soreness after exercise, or catching cold), to cut down on their proteid and substitute fat to restrain the gastric juice. This advice was intended to make

application of the theories of Folin[1] that we usually carry a reservoir of proteid, enough to supply our needs for body-building for a fortnight. If this reservoir is exhausted, proteid starvation occurs and the body feeds on itself ; if it is filled too far it overflows and causes the evils of excessive proteid. If this theory is correct, the art of eating may consist largely in maintaining a golden mean such that the proteid reservoir is neither empty nor overflowing, or at any rate, not overflowing much. Many persons fear to reduce their proteid to the Chittenden minimum for fear of proteid starvation ; but the experience of those who have tried it would seem to show that this fear is groundless, *provided* no violence is done to natural appetite. This may be trusted, so it would appear, to raise a warning in the form of "nitrogen hunger" before the danger point is reached.

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[1] "A Theory of Protein Metabolism." *American Journal of Physiology*, March, 1905.

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RELATIONS BETWEEN BERMUDA AND THE AMERICAN COLONIES DURING THE REVOLUTIONARY WAR

BY

ADDISON E. VERRILL

NEW HAVEN, CONNECTICUT
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II.—Relations between Bermuda and the American Colonies during the Revolutionary War. By A. E. Verrill.

In this brief account the following subjects will be discussed :

1. Commercial and social relations before the war ; dependence of Bermuda on the Colonies for foodstuffs, clothing, etc.
2. Seizure of the Bermuda gunpowder in 1775.
3. Bermuda privateers.
4. Plans for the capture of Bermuda by the Americans and French.
5. Biographical Sketches.

In order to appreciate the attitude and conduct of the inhabitants of the Bermudas during the Revolutionary war, it is necessary to consider the peculiar conditions under which they had long lived and their intimate relations with, and dependence upon, the American Colonies.

1. *Commercial and social relations.*

After the decline and final cessation of tobacco cultivation,* about 1700, the inhabitants of Bermuda became very much impoverished, for they had few products to export and were unable to raise sufficient foodstuffs to support themselves. This condition continued down to and after the Revolutionary war.

During that period they were largely dependent upon their traffic with the American Colonies for their food and clothing. Cessation of that traffic meant destitution, if not famine, for them. The islands were over-populated† and they had a superabundance of negro slaves, without adequate employment for them. Agriculture was pursued on a small scale and in the most primitive manner.

The amount of arable land suitable for cereals was small. Cultivation of the soil by the whites was considered degrading. The slaves were very ignorant and without proper tools, plows and harrows being then unknown there.‡ Under such circumstances many of the more enterprising men emigrated to America and went into com-

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* See The Bermuda Islands, A. E. Verrill, vol. i, pp. 555–560.

† The population in 1787 was estimated at 10,381, of whom 4,919 were colored. See The Bermuda Islands, vol. i, pp. 561–565, 570.

‡ Plows, yokes, and various other agricultural implements were first introduced by Governor Reid, 1839–40. See The Bermuda Islands, i, pp. 557, 895.

merce. Some undertook the building of vessels, the Bermuda cedar being admirably adapted for that use ; others erected salt works at Turks Island, in the Bahamas,* and went there during the winter season to manufacture salt, most of which they took to the American Colonies to exchange for food and clothing, for salt was their principal export. Thus it came about that Bermudian vessels, for more than sixty years, had monopolized a large part of the West Indian and coastwise commerce of the American Colonies. Many native Bermudians, from the best families, had gone to America for their education, and many went into business or the learned professions there. These various intimate business relations and family ties, as well as their own cherished love of liberty, naturally led to friendliness and sympathy with the Americans during the war. Besides, they had themselves suffered greatly, in previous years, by oppressive English laws. The Bermudians, however, like the Americans, were divided into two parties. Those who were opposed to the British Government, or at least to its treatment of the Colonies, seem to have been largely in the majority. They were repeatedly denounced by the Governors as rebels and traitors. On the other hand, even the members of the Assembly did not hesitate to openly oppose and criticise Governor Bruere in no measured terms, while he in turn denounced them and other local officials as traitors. This mutual enmity continued from 1775 to 1782, under three successive governors. It culminated in September, 1780, when the Governor dissolved the legislative Assembly for rebellious conduct.

It is certain that very many of the inhabitants of Bermuda were willing and ready to aid the Americans in every way they safely could. It is also a matter of official record that the Continental Congress granted very unusual and highly important favors to the Bermudians, by sending them large amounts of provisions ; allowing them free importation of salt ; permitting them to enter the harbors ; and exempting their vessels from capture by American privateers. Such privileges were not granted to other English colonies. If the American Colonies could have maintained a suitable fleet to hold the islands, their capture would have been easy, and no doubt welcomed by the majority of the people.

The first act of the Colonies that affected Bermuda was the resolution adopted Friday, the 30th of September, 1774 :† "Resolved,

* The Bermudians erected salt works there as early as 1678. See The Bermuda Islands, i, p. 520.

† Secret Journals of the Continental Congress, vol. i, p. 21 (Philad. ed. 1800).

That from and after the 10th of September, 1775, the exportation of all merchandize and every commodity whatsoever, to Great Britain, Ireland, and the West Indies, ought to cease, unless the grievances of America are redressed before that time."

In a resolution adopted Aug. 1, 1775, defining the islands and colonies with which commerce was prohibited, the "Summer Islands," or Bermudas, were specifically mentioned.*

Before the resolution went into effect, the Bermudians had presented more than one petition stating their lack of provisions and begging for relief. At the session July 11, 1775, an "Address from the inhabitants of Bermuda" was presented.† This document is not preserved, but was probably one of those referred to at the session of Nov. 22, 1775.

On July 17, 1775, the following was recorded :‡ "The address from the Deputies of the several parishes of the islands of Bermuda being again read, ordered : That the President return them an answer, acknowledging the receipt of the address and informing them that it will be considered, and desiring them to send an account of the provisions imported for some years past for the use of the inhabitants of that island ; and also enclose therein a copy of a resolve entered into on Saturday last, respecting the importation of gunpowder, etc."

This reference is to a resolution introduced by Benjamin Franklin, and passed July 15, 1775,§ in which it was provided that any vessel importing gunpowder, saltpeter, sulphur, or firearms, should be allowed to export products of any kind, of equal value, thus assuring a profit at each end of the voyage. This was evidently a great inducement to the people of Bermuda to engage in that kind of traffic, to obtain the foodstuffs and clothing that they so badly needed.

After the seizure of the gunpowder at Bermuda, in August, and evidently, as will be shown later, as a reward for their aid in that affair, the attitude of Congress suddenly changed.

Under date of Wednesday, Nov. 22, 1775, the following entry occurs :‖ "The committee of the whole, to whom are referred the several petitions from the islands of Bermuda, representing the dis-

* Journals of the Continental Congress, vol. ii, p. 239, Washington ed., 1905.

† Journal Continental Congress, i, p. 150.

‡ Secret Journ. of The Continental Congress, vol. i, p. 21, ed. of 1800.

§ Journal Continental Congress, ii, p. 184, ed. 1905.

‖ Journal of Continental Congress, i, p. 236, 237, Boston ed., 1821.

tress to which they were exposed, by the non-export agreement, and praying to be relieved in such manner as the Congress may deem consistent with the safety of America, report that they have considered the same, and thereupon came to the following resolutions: That the inhabitants of the Islands of Bermuda appear friendly to the cause of America and ought to be supplied with such and so great of the products of these colonies, as may be necessary for their subsistence and home consumption; that in the opinion of this committee they will annually require for the purposes aforesaid:

72000 bushels of Indian corn,
2000 barrels of bread or flour,
1000 barrels of beef or pork,
2100 bushels of peas or beans, and
300 tierces of rice,

and that they be permitted to export the same yearly. That the said inhabitants ought to pay for the above annual allowance in salt, but it is not the design of this resolution to exclude them from the privilege of receiving American goods to any amount in exchange for arms, ammunition, saltpeter, sulphur, and field pieces, agreeably to a resolution passed the 15th of July last. That to enable each of the colonies, as can conveniently furnish the islands of Bermuda with the above mentioned allowance, to divide whatever advantages may result therefrom, in proportion to their respective shares of the general expense, it is further the opinion of the committee that the colony of South Carolina supply them with 300 tierces of rice; that the colony of North Carolina supply them with 16000 bushels of Indian corn, and 468 bushels of peas or beans; Virginia with 36000 bush. of Indian corn, and 10500 bush. of peas or beans; Maryland with 20000 bush. of corn and 552 bush. peas or beans. Pennsylvania with 1200 barrels of flour or bread, and 600 barrels of beef or pork; New York with 800 barrels of flour or bread and 400 barrels of beef or pork.

Also to inform the inhabitants of Bermuda that Congress would also supply them with other necessaries, such as lumber, soap and candles, whenever the quality and quantity of those articles used in the islands be ascertained. That Edw. Stiles be permitted, under the direction of the Committee of Safety of the Colony of Pennsylvania, to send the brig "Sea Nymph," Sam'l Stobel master, with 4000 bushels of Indian corn, 300 barrels of flour, 100 barrels of bread, 20 barrels of pork, 8 barrels of beef, 30 boxes of soap,

and 15 barrels of apples, to Bermuda for the immediate supply of the inhabitants, and that the said cargo be considered as a part of the annual allowance aforesaid, for the year ensuing."

Other cargoes of provisions are recorded as having been sent to Bermuda. Among them are the dates : June 5, 1776 ; May 18, 1779 ; Aug. 30, 1880, etc. The Secret and Marine Committee, 'charged with fitting out vessels with cargoes to Bermuda," was discharged Aug. 2, 1776. But an act had been previously passed, July 24, 1776, making an exception in favor of Bermuda vessels, and permitting them to enter American ports for commercial purposes. But as the governors of Bermuda considered all such traffic treasonable, it must have been carried on secretly and with considerable risk. Thus more or less destitution continued in Bermuda during the war, as the records show. The receipt of a letter or petition is mentioned on May 30th, 1776. It was taken up at the session of June 6th, when the committee reported upon it as follows :—*

"The committee to whom was referred an extract of a letter from a gentleman in Bermuda,† dated 26th April, and continued to May 1st, to a gentleman in Philadelphia, brought in their report, which was read, and the same being taken into consideration : Resolved, That the Secret Committee be instructed to fit out two fast sailing vessels and load them with provisions, to be sent immediately to supply the inhabitants of the islands of Bermuda, and that the committee of secret correspondence be directed to take such means as they may think proper, by these vessels, to discover the state of those islands and the disposition of the inhabitants ; and that the marine committee be instructed to take such measures as they may think proper, for purchasing, manning, arming, and fitting at the said islands, of two sloops of war for the service of the United Colonies."

No report of the results of this expedition has been found on the records.

In 1878–9 the islands were allowed to send from each parish one licensed vessel to Savannah, New York, or other English ports, to obtain provisions ; but they had very little to offer in exchange.

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* Secret Journ. Continental Congress, i, pp. 45, 46, 47 (ed. 1800).

† The gentleman here referred to was, without much doubt, Mr. Silas Deane, at that time in Bermuda, where he had stopped to purchase a "fast sailing vessel" while on his way to France, as instructed by Congress. See below, p. 60, for an extract from one of his letters, probably the same one here referred to.

II. *Seizure of the Gunpowder in 1775.*

That the American army was at first in desperate need of gunpowder and other munitions of war, is well known. General Washington, from the very first, used the most strenuous efforts to increase the supply and economize what he had. The manufacture of saltpeter and the gathering of sulphur were encouraged by special acts of Congress in the summer of 1775. It is well known that in August, 1775, the gunpowder stored in a public powder magazine in Bermuda was secretly seized by an American expedition and brought to the Colonies to supply the armies in the field, who were then sorely in need of it. The affair caused great excitement in Bermuda at the time, but none of the inhabitants were proved guilty of aiding in the enterprise, although the governor and other officials made great efforts to do so. The transaction has to this day remained very much of a mystery. The lives of those engaged in it were at stake, both in this country and Bermuda, for the result of the impending war was then very uncertain. Various more or less romantic and fictitious incidents have been connected with the affair in Bermuda, but they seem to rest on no basis whatever. The powder was certainly taken away in the night, with no apparent disturbance. At that time Bermuda was very poorly fortified and weakly garrisoned. It is said in Bermuda that the barrels of powder were rolled through the governor's garden. Even now, though several have written on the subject, the amount of gunpowder taken, its destination, the persons concerned, and the name of the vessel or vessels that took it away are not positively known. No direct mention of the act is found, to my knowledge, in any American official record.

In the following pages I have reviewed all the official American records known to me that have been supposed to refer to the affair, and have collected all the other evidence available. Very likely careful researches in the official records of that period in Bermuda and London might bring out some additional evidence, but the secrets of the persons concerned seem to have been well kept.

As many of the warlike undertakings of the Continental Congress were at that time delegated to the "Secret Committee of Marine and Commerce," very little is to be learned from the official records in regard to this transaction. It was probably undertaken, like the later expedition of Capt. Whipple, in accordance with the urgent desire of General Washington, who, in his letters, refers to a Mr.

Harris, as one of the persons who had told him of the powder there.

The only official record that has been supposed to refer to it, and that very doubtfully, is in the Pennsylvania Committee of Safety minutes, Sept. 20, 1775,* pp. 340, 341, where it is stated that 1800 pounds of powder had been imported from Bermuda by Capt. Ord in "The Lucy"; of this, 700 lbs. were noted as damaged and "not fit to use." Some writers have stated that 100 barrels of powder and many other stores were taken from the Bermuda magazine. But there is no official record of this. A few days after the expedition under Captain Whipple had sailed (Sept. 12), it was publicly announced, it was said, perhaps in the newspapers, that 100 barrels of gunpowder had arrived from Bermuda. I have not been able to consult the newspapers of that date. Perhaps "The Philadelphia Packet," a semi-official organ, was the authority referred to.

The official records give Aug. 6, 1775, as the date when the powder imported in the "Lucy" was received in Philadelphia. But Mr. DeLancey Cleveland† states that the powder was seized Aug. 14, 1775. If the latter date be correct, the former record must refer to a previous importation by Capt. Ord. This is not unlikely, for Capt. Ord owned more than one vessel, and was then engaged in commerce. Moreover, a subsequent importation of gunpowder from Bermuda is on record, and there may have been various others, for considerable illicit traffic was continually carried on by the Bermudians, according to the charges made by their governor at that time. The Continental Congress had already offered special rewards for the importation of gunpowder and firearms. The unusual favors subsequently granted to the Bermudians (see especially the act of Nov. 22, 1775, above, p. 49), indicate that much larger contributions than the 1800 lbs. of powder, about half of it "unfit for use," had been received from them.

I am, therefore, now led to believe that the importation in the "Lucy" was entirely independent of the powder taken from the large magazine.‡

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* Vol. x, pp. 277–784, Harrisburg ed., 1852. See The Bermuda Islands, i, p. 873 (461).

† See article "How Washington got his Powder," in New York Evening Post, Feb. 24, 1904; reprinted in the Bermuda Royal Gazette, March 29. By DeLancey Cleveland, a great-grandson of Capt. George Ord.

‡ According to tradition in Bermuda powder was taken from more than one magazine for the Americans.

It seems quite probable that Captain Ord had previously been informed of the gunpowder in Bermuda, and of the means of securing it, and that when he heard of the rewards offered by Congress for the importation of gunpowder, he hurried back to Bermuda and secured it. The intervening time was sufficient for that purpose. But whether the Americans took it from the magazine, or received it from friendly Bermudians, who had taken it out to them in boats, is uncertain. In Bermuda the latter view seems to have been held. The voyage from Bermuda in the sailing vessels of that period usually took at least a week, and usually a longer time in summer. So that if the seizure took place on Aug. 14th, the powder could not have reached Philadelphia before the 22d to 28th, and probably rather later than that, perhaps a week or more later. Possibly it may have been taken directly to New York, Providence, or some other port nearer to Washington's army than Philadelphia. But it is certain that Washington had not heard of its arrival up to Sept. 6th, when he wrote the circular letter to the Bermudians, to be taken there by Capt. Whipple, and probably he had not heard of it before Capt. Whipple sailed, Sept. 12th. This would tend to make the date of Aug. 14th, for the seizure, seem more probable. The powder that was received by the "Lucy," Aug. 6, must have left Bermuda about July 28th, or earlier. According to some traditions and published accounts, there were two vessels concerned in the seizure: one of them from South Carolina, and the other from Philadelphia. If so, part of the gunpowder may have been taken directly to South Carolina, where it was much needed at that time. It is probable that, as a matter of safety, no official record was made of the arrival of this captured powder. Many of the warlike acts of the secret committees of that period were never recorded, for good and sufficient reasons, as affairs then stood.

Recently, Miss Caroline Clifford Newton, daughter of the late Professor H. A. Newton, of Yale University, has called my attention to the fact that Captain Samuel Stiles, of Georgia, has been reputed to have taken a part in the seizure of the gunpowder. He was the great-great-grandfather of Miss Newton. He was an adventurous ship captain, who owned his own vessels, and was engaged in commerce at that time. Miss Newton states that according to family traditions he took a prominent part in that affair, importing some of the powder in his own ship. He may, indeed, have commanded the second vessel, said, in the contemporary accounts, to have hailed from South Carolina, as mentioned above.

In the "Historical Collections of Georgia," by the Rev. George White, p. 276 (New York, 1855), the author mentions Capt. Samuel Stiles,* and says: "It is said that the Bermudians being in a starving condition, stole the government powder from the magazines and sold it for provisions, and that Mr. Stiles was the person who arranged the trade and carried off the powder."

Mr. White also states that Capt. Stiles was engaged, during the war, in importing powder from the West Indies, both for Congress and for the colony of Georgia.

The gunpowder mentioned in the minutes, quoted above, was recorded as having been imported by Capt. Ord in the "Lucy." But one of Capt. Ord's descendants, Mr. DeLancey Cleveland, says that according to family traditions the powder taken from the magazine was brought away in the "Retaliation." Capt. Ord received a commission from the Continental Congress, Dec. 4, 1776, as a privateer in command of the brigantine "Retaliation," of 90 tons, armed with 14 guns, and manned by 100 men. His commission, a copy of which I have at hand, is now in the possession of Mr. Cleveland. It was signed "By order of The Congress, John Hancock, President."

As no commissions to privateers† were granted by Congress or the Colonies up to 1776, according to the best authorities, Capt. Ord was not a privateer in 1775, though he doubtless had a commission and official orders of some kind—perhaps from the Governor of Pennsylvania.‡ There is no evidence that his vessel, the "Lucy," was armed at that time, though it was then usual to arm even mercantile vessels for defence. It is not improbable that the name of the vessel might have been changed from "Lucy" to "Retaliation" when it was put in commission as a privateer, but there is no evidence of this. The latter indicates a name given after hostilities had begun, and perhaps after the loss of a vessel by capture, but Capt. Ord is said to have owned more than one vessel during the war.

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* According to Mr. White, Capt. Stiles came to America about 1769, and owned a plantation in Bryan County, Ga. When the war broke out his family was in Bermuda, but he early joined the cause of the Colonies. He was present at the siege of Savannah.

† The first resolution of Congress in regard to giving commissions to privateers seems to have been on March 23, 1776.

‡ It is a tradition among his descendants that Capt. Ord fitted out this expedition at his own expense. Mr. De Lancey Cleveland informs me that the family tradition is not very positive as to the name of the vessel.

A little later* there is a record of the arrival of "eight half barrels of powder" shipped from Bermuda by Henry Tucker, "Chairman of the Deputies of several Parishes of Bermuda." It is recorded as having belonged to Capt. John Cooper of North Carolina, and was intended for the use of that colony. There is no reason to suppose that this was not a private shipment.

It has often been said that the arrival of the gunpowder from Bermuda enabled Washington to recapture Boston on March 17, following. I have not been able to find any reliable evidence of this. It appears that Congress supplied Washington's army at that time with gunpowder from any and every available source. Probably the Bermuda gunpowder was put into the general supply. Doubtless some of it, if not all, reached Washington's army, at Cambridge, as there was ample time, but I have found no record of its arrival.

Just before the arrival of the small supply on the "Lucy," a much larger quantity had been ordered sent to General Washington from Philadelphia.

The Continental Congress on Aug. 1, 1775,† "Resolved, that out of the powder belonging to the continent now in this city, five tons be sent to General Washington in the speediest and safest manner by the delegates of the colony of Pennsylvania," and that "out of the next that arrives" 1,000 lbs. should be allotted to New Jersey, and "out of the same parcel" one ton should be reserved for N. Carolina, to be lodged in the "magazine of New York," if not required by Gen. Washington or Gen. Schuyler. Perhaps this lot that was soon expected was the Bermuda gunpowder. If so, the storing of part of it in the New York magazine would indicate that it was taken directly to New York from Bermuda.

It is claimed by the descendants of St. George Tucker,‡ who came to Virginia several years previously (1771) and took an active part in the cause of the colonists, that he was active in securing the gunpowder. But precisely what he actually did do seems to be unknown. He may have helped to make the plans for the seizure.

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* See New Eng. Hist. and Gen. Records, vol. 1, No. 4, p. 441, Oct., 1896.

† Journals of the Continental Congress, ii, p. 238, ed. 1905.

‡ See the article by J. T. McLaughlin, Jr., his great-grandson, in The Royal Gazette, March 15, 1904, reprinted from The New York Evening Post, March 5, 1904, p. 8, in reply to an article by Mr. C. E. Hayward, Feb. 20, 1904, Supplement, p. 1. Mr. Hayward stated that the powder was put aboard of two Bermuda vessels off the North Rocks. This is a very doubtful tradition.

It is a matter of record that he was sent to Bermuda (June, 1775), just before the event, and that he did not return to Virginia till Nov., 1776. So it would appear that he had other objects in charge beyond the securing of the gunpowder. I do not find that he was accused of having a hand in it at that time. While in Bermuda he was admitted to the local bar.

It is probable that the American sailors did the actual work of removing the gunpowder, and that some of the inhabitants of Bermuda may have acted as guides and as pilots for the boats, in that night adventure.

Shortly after the Rhode Island expedition had sailed and the news of the arrival of the powder had been received, a second vessel was sent from Rhode Island to notify Capt. Whipple. Both vessels reached Bermuda and their people were well received by the inhabitants, who told them of the previous capture of the powder.

It is stated that Capt. Whipple, while there, entertained on board his vessel five members of the Council, who assured him that "the people were hearty friends of the American Cause and heartily disposed to serve it." He returned Oct. 20, 1775.

It appears, from documents, that these vessels anchored off the southwestern end of the islands, and that there were British war vessels at the other end. But the latter did not venture to attack the Americans.

Capt. Whipple was also told that the Governor had notified General Gates of the seizure of the powder, and that he had sent from Boston an armed sloop and a transport, which were then in St. George's harbor.

In accordance with the promises of General Washington, the Continental Congress, in November, soon after the powder had been received, ordered a cargo of provisions sent to Bermuda to relieve the immediate distress of the inhabitants, and also allowed annual shipments; and later permitted private firms to send cargoes there from several of the Colonies. (See above, p. 49.) It also allowed salt to be brought back in payment for provisions. Moreover, a law was passed, November, 1777, exempting Bermudian vessels from capture by American privateers. This exception was contained in all the letters of marque issued after Nov. 27, 1777.

Inasmuch as Congress had specifically named the "Summer Islands" among the places with which trade was prohibited, in its act of Aug. 1st, the arrival of a large amount of gunpowder from thence through

the friendly aid of the Bermudian people, is the only logical explanation of the sudden change in its attitude.

Before Gen. Washington heard of the success of this first expedition he made an urgent appeal* to Gov. Cooke of Rhode Island to send one of the armed vessels of that colony to Bermuda. This plan was approved by the Governor and Committee of Rhode Island, and the vessel was dispatched Sept. 12, 1775, in command of Capt. Abraham Whipple, who carried with him a circular letter from General Washington, dated Sept. 6, 1775, to the inhabitants of Bermuda,† asking them to aid, so far as they safely could, in this enterprise, and promising in return to use his influence with Congress to secure the sending of much needed provisions, and obtain other favors for them. The following is an extract from General Washington's letter :—

"We are informed that there is a very large magazine in your island under a very feeble guard. We would not wish to involve you in an opposition in which, from your situation, we should be unable to support you ; we know not, therefore, to what extent to solicit your assistance, in availing ourselves of this supply; but if your favour and friendship to North America and its liberties have not been misrepresented, I persuade myself you may, consistently with your own safety, promote and further this scheme, so as to give it the fairest prospect of success. Be assured that in this case the whole power and exertion of my influence will be made with the honorable Continental Congress, that your island may not only be supplied with provisions, but experience every other mark of affection and friendship which the grateful citizens of a free country can bestow on its brethren and benefactors."

III. *Bermuda Privateers.*

Notwithstanding the friendly relations, there were in Bermuda plenty of people who held the same views as the loyalists in America. Some fitted out privateers to prey upon American commerce and enrich themselves, as the Governor, George J. Bruere, advised. A privateer's commission was given, Jan. 10, 1778, to Capt. Bridger Goodrich, in command of the "Hammond" of 100 tons, 8 guns, and 20 men, to "cruise against the American colonies." It was armed

* In his letter, dated "Camp at Cambridge, 4 Aug., 1775." General Washington mentioned the great and pressing need of gunpowder for the army and the very precarious supply. He also said: "No quantity, however small, is beneath notice, and, should any arrive, I beg it may be forwarded as soon as possible."

† This letter has been published in full in several books. See J. Sparks, "Writings of George Washington," iii, p. 77. Also Stark's Bermuda Guide, pp. 35–37, 1898.

by Robt. Shelden and Wm. Goodrich, merchants of Bermuda. Several other privateers were fitted out there and commissioned by Gov. George James Bruere,* in 1778 to 1780, "to cruise against the French, Spanish, and Americans." Gov. George Bruere. in one of his earliest addresses, Nov. 23, 1780, also referred to their great success and urged the fitting out of more. Among those recorded were the "Miraculous Pitcher," Capt. H. Middleton; sloop "Whalebone," Capt. John Brice; the "Spitfire"; the "Jolly Bacchus." Others might be found recorded, very likely, by a more thorough search of the Bermuda records.

In an address by Gov. George Bruere, June 19, 1781, he said that "a noble ship" was being fitted out as a privateer by a private family, and added: "I flatter myself her success, as well as the good fortune the other armed vessels constantly meet with, will convince the reasonable and dispassionate that interest as well as duty lay on the side of equipments against our Confederate Enemies."

Some of the Bermuda privateers were also captured by the Americans. One which was captured and taken to Boston and condemned there had 70 negro sailors on board.

I have not attempted to compile a list of American vessels captured by the Bermudian privateers and condemned there, but a considerable number are recorded.

After the arrival of Governor Wm. Brown, in 1782, privateering was discouraged † He said "the spirit of privateering will draw the resentment of the enemy."

IV. *Plans for the Capture of Bermuda by the Americans and French.*

Although the various petitions and letters from the Bermudians, referred to in the journals of the Continental Congress, have not been preserved, the character of the wording of the resolutions is sufficient to show the strong sympathy between the Bermudians and Americans. It is well known that there were many in authority in this country who advised the capture of Bermuda. Very likely the

* Gov. George James Bruere, appointed 1764, died in Aug., 1780. He was succeeded by Lt.-Gov. Thos. Jones, Sept., 1780. He was replaced Oct., 1780, by Gov. George Bruere. who was replaced by Governor Wm. Brown, Jan. 4, 1782.

† Governor Brown was a native of Salem, Mass. He was a very able and much respected citizen, and an eminent jurist. He was, however, a devoted loyalist, and was obliged to leave his country and sacrifice his property on that account. His letter as to privateering is in "The Lansdowne MSS." vol. 78.

visit of Mr. St. George Tucker to Bermuda, from June, 1775, to November, 1776, was only in part to secure gunpowder. It may have been more particularly to promulgate the revolutionary ideas of the American Colonists.

It is not improbable that he was also instructed to ascertain the disposition of the people in regard to the plan for the capture of Bermuda, and its practicability, and to enlist their aid and sympathy in other ways. He came back with a cargo of salt, which was then much needed. After he returned to America he joined the Continental army. He became a Lieutenant Colonel in 1789, and was wounded in the battle of Guilford Court House. He was appointed Professor of Law in 1789, and Judge of U. S. District Court in 1815. (See biographical sketch below.)

It is certain that Bermuda was at that time very poorly fortified and feebly garrisoned. St. George's was the only town and principal harbor, for Hamilton was not made the capital till 1812. But the garrison was greatly increased in 1778 and 1779. Gen. Sir Henry Clinton, writing to Lord George Germain, Oct. 8, 1778, stated that he had sent 300 men to garrison Bermuda; and in a later letter, Nov., 1779, he says, "I have sent an additional force to Bermuda. That place is of the greatest consequence."

Probably some of the old and more or less ruined forts, built long before about St. George's harbor and on Castle Island, etc., were repaired and garrisoned at that time.*

Mr. Silas Deane, a member of Congress, who was sent as a secret agent to the Court of France in 1776, stopped, on his way, at Bermuda and there purchased a fast sloop in which he sailed to Bordeaux, arriving June, 1776. In a letter from Bermuda, April, 1776, he described the destitute condition and distress of the inhabitants and said that a famine was inevitable unless they could live entirely on fish or get food from America.† He also described the harbors and channels, and advised the Congress to take possession of the islands and fortify them at both ends, and thus make a safe harbor for the building and fitting out of vessels to destroy the British commerce with the West Indies. In another letter, dated Paris, Aug. 18, 1776, he referred to the same subject and said that the English government intended to fortify the islands during the fol-

* See The Bermuda Islands, vol. i, pp. 449–463.

† See above, p. 51. This letter was apparently the one there referred to, and acted upon by Congress.

lowing winter and spring and that France would take possession of them "on the first rupture."

He also stated that the Bermudians had sent a petition to the English government declaring the necessity of getting provisions from America, and saying that if not permitted to do so, they must ask the protection of the Congress.*

In consequence of Mr. Deane's letters and other information, Congress immediately ordered two "fast-sailing vessels" to be loaded with provisions and sent to Bermuda, June, 1776. The officers were instructed to ascertain "the disposition of the people," and also whether two armed vessels could be purchased and fitted out there. (See above, p. 51.) Their report does not appear to have been recorded.† Doubtless it was deemed impracticable to take the islands at that time, for the Americans then had no war vessels of any importance and could not have held the islands against the English fleet, even with the assistance of the French fleet.

But plans for the capture of Bermuda were not entirely abandoned until long afterwards, for references are repeatedly made to it in the official letters preserved in the archives, both in Europe and America. In the letters of Mr. Hopkins (Brigadier in the French Service) to Compte de Vergennes, Sept. 9 and Sept. 14, 1776, he mentions the capture of Bermuda as a part of his plans ‡

In the Treaties of Commerce and Alliance between France and America, signed Feb. 6, 1778, it was stipulated that all the West Indies, if conquered, should belong to France, but that Bermuda should be added to the United States.

In the letters of Marquis de Lafayette to Compte de Vergennes, July 3, and July 18, 1779, and in other letters, he mentions the capture of Bermuda for the Americans as a part of his plans. Lafayette contemplated a visit to Bermuda, personally, to organize a liberty party, as stated in a letter to Compte de Vergennes, Feb. 2, 1780. He said, "Nous pouvous en passant toucher a la Bermude et y etablir le parti de la liberte."

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* See also New Eng. Historical and Geological Reg., vol. 1, No. 4, Oct., 1896, p. 441.

†. All such matters were at that time referred to a Secret Committee of Marine and Commerce, and very little is on record as to its doings.

‡ See Stevens, Benj. Franklin (editor). Facsimiles of manuscripts in European Archives relating to America, 1773–1778, Nov., 1889–Feb., 1898, folio. See Abstracts in G. Watson Cole, Bermuda in Periodical Literature, Bulletin of Bibliography, iii, Nos. 8, 9, Jan.–Feb., 1904, of these and several other letters regarding the capture of Bermuda by the French.

One of the means of communicating with friendly Bermudians is shown in a letter of information communicated by Lieut.-Col. Edward Smith, Oct. 22, 1777 : "All American ships falling in with Bermuda Islands must stand for the West end, and by their hoisting a jack at the maintopmast head, a Mr. Tucker would send off a boat, and procuring them, as required, assistance, would give them orders or satisfactory information."

V. *Biographical Notes on some of the persons mentioned.*

St. George Tucker.* He was born at Port Royal, Bermuda, July 10, 1752, and died near Warminster, Va., Nov. 10, 1827. His parents were Henry and Anne (Butterfield) Tucker. He was a descendant of George Tucker of Kent, England, who was a prominent member of the Warwick party in the Virginia Company of London, and of his eldest son, George Tucker, who emigrated to Bermuda among the earliest settlers and became a land owner and planter of tobacco there. The latter was a nephew of Governor Daniel Tucker (1615–1616), famous for his strenuous government of his unruly subjects.†

St. George Tucker came to Virginia in 1771, to complete his education, and graduated at the College of William and Mary in 1772. He afterwards studied and practiced law. He went to Bermuda, June, 1775, and was admitted to the bar there, July, 1775. In November, 1776, he returned to Virginia with a cargo of salt. In 1777 he engaged, with his brother Thomas, in importing gunpowder and other munitions of war from the West Indies. He soon entered the army. He was Aide-de-camp to General Thos. Nelson in 1779 ; Major in 1781. He served with General Greene in the south, and was wounded in the battle of Guilford Court House, March 15, 1781. He became Lieut.-Colonel, Sept. 12, 1781, and was sent as a delegate with Edward Randolph and James Madison to the Annapolis Convention in 1786. It is said that he was the person who made the report of the famous speech of Patrick Henry.

After the war he resumed the practice of law, and became a judge in 1787. He was appointed Professor of Law in the College of William and Mary, 1789–90, and was judge of the U. S. District Court of Virginia, 1813–25. He also held other important offices. He wrote a number of important legal works, and had a good literary reputation, both as a writer of prose and poetry.

* The dates here given are mostly from Lamb's Biog. Dict. United States, 1903, vol. vii, p. 387. Other biographical works give some of them differently.

† See "The Bermuda Islands," vol. i, pp. 447, 476, 551, 624, 630, 713, 719, 875.

His sons and several of his later descendants have also been eminent in law and other professions.

His elder brother, Thomas Tudor Tucker, who was born in Bermuda, 1745, and emigrated to South Carolina, was a surgeon in the army, and was a delegate to the Continental Congress, 1787–8, and representative in the United States Congress subsequently, 1789–1793; from December, 1801, to his death, May, 1828, 27 years, he was Treasurer of the United States.

Capt. George Ord was born in England, May 26, 1741. He died Oct. 13, 1806. He came to America when 18 years old. He carried on a ship chandlery, together with a rope-walk in Philadelphia, before the war, and had already acquired considerable knowledge of naval affairs in England. These occupations and his experience made him useful in the first formation of the Naval Board, as shown by letters to him, still preserved, from Thomas Wharton, "First President of Council."*

He was an uncle of George Ord, Esq., a well known naturalist of Philadelphia, and for many years an active member of the Academy of Natural Sciences and American Philosophical Society. He was a friend and patron of Wilson, the ornithologist, and edited his Ornithology, writing the last volume himself. He was also intimate with Audubon, Lesueur, and other notable naturalists of that period. It was through him that the papers and relics of Capt. Ord were transmitted to his nephew, DeLancey Cleveland, who wrote the article on the capture of the gunpowder, referred to above.

The following is a copy of the commission of Capt. George Ord. The original is preserved by Mr. DeLancey Cleveland:

IN CONGRESS.

The Delegates of the United States, of New Hampshire, Massachusettes Bay, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, the Counties of New Castle, Kent and Sussex on Delaware, Maryland, Virginia, North-Carolina, South-Carolina, and Georgia,

To all unto whom these Presents shall come, send Greeting: Know Ye,

That we have granted, and by these Presents do grant Licence and Authority to George Ord Esq^re^ Mariner, Commander of the Brig^a^ called Retaliation of the Burthen of 90-Tons, or thereabouts, mounting fourteen Carriage Guns, and navigated by 100 Men, to fit out and set forth the said Brig^a^ in a

*For these particulars I am indebted to Mrs. DeLancey Cleveland, of New York.

warlike Manner, and by and with the said Brigantine and the crew thereof, by force of Arms, to attack, seize and take the Ships and other Vessels belonging to the Inhabitants of Great-Britain, or any of them, with the Tackle, Apparel, Furniture and Ladings, on the High Seas, or between high-water and low-water Marks, and to bring the same to some convenient Ports in the said Colonies, in Order that the Courts, which are or shall be there appointed to hear and determine Causes civil and maritime, may proceed in due Form to condemn the said Captures, if they be adjudged lawful Prize; the said George Ord having given Bond, with sufficient Sureties, that nothing be done by the said George Ord or any of the Officers, Mariners or Company thereof contrary to, or inconsistant with the Usages and Customs of Nations, and the Instructions, a Copy of which is herewith delivered to him. And we will and require all our Officers whatsoever to give Succour and Assistance to the said George Ord in the Premises. This Commission shall continue in force until the Congress shall issue Orders to the Contrary.

By Order of the Congress.

JOHN HANCOCK, President

Dated at Philadelphia
the 4th day of Decemb 1776.

That the Assembly and people of Bermuda were fully justified in their quarrels with Gov. Geo. James Bruére is obvious from the facts that are recorded in history, showing plainly his tyrannical character and merciless disposition. Doubtless there were multitudes of other grievances well known to his contemporaries.* It was under his régime that the disgraceful and fatal treatment of the American prisoners of war took place, and for which he was, no doubt, mainly responsible.

The privateers took large numbers of prisoners. They were crowded into the small unsanitary jail at St. George's, till the conditions became too horrible to relate.† Consequently a malignant "jail fever" broke out in the jail, eventually spreading, in 1779–80, over all the islands, causing untold suffering and hundreds of deaths, both among the natives and prisoners.

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*Debates of the Assembly were not open to the public till 1784; the first newspaper, The Bermuda Gazette, was started Jan., 1784, under Gov. Brown.

†See "The Bermuda Is.," ed. I, p. 104.

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MATURATION OF THE EGG OF THE WHITE MOUSE

BY

WILLIAM B. KIRKHAM

NEW HAVEN, CONNECTICUT
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III.—Maturation of the Egg of the White Mouse.

By William B. Kirkham.

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I.—*Literature relating to the Mammalian Ovum.*

So far as known, the first person to discover the cleavage stages in any mammalian egg was R. de Graaf (1678), and subsequent to his researches no further investigations in this line are met with until 1797, when an Englishman, William Cruikshank, published "Experiments in which," to quote the quaint title, "on the third Day after Impregnation, the Ova of Rabbits were found in the fallopian Tubes; and on the fourth day after Impregnation, in the uterus itself; with the first Appearances of the Foetus." Cruikshank noted some rabbit's eggs before cleavage, a few at the two-celled stage, and some very young embryos.

The discovery of the ovarian eggs of mammals was made by K. E. von Baer ('27, '28), who also observed some cleavage stages in eggs of the rabbit, dog, and pig. However, the study of mammalian cytology, as such, may be said to date from the work of an English doctor, Martin Barry, who, in 1838–39, published two papers in the Philosophical Transactions of the Royal Society of London, the first dealing with the ovarian eggs of rabbits, and the second with the growth and discharge of these eggs from the ovary. Barry figures ovarian eggs of various animals, including not only the rabbit, but the hog, sheep, ox, dog, cat, and tiger, having been presented with some ovaries of the last-named animal by the comparative anatomist, Richard Owen. He found that the time of ovulation varied in the rabbit, but is commonly from 9 to 10 hours after copulation.

Then follows a series of investigations on the eggs of the rabbit, dog, guinea-pig, and deer, by Bischoff ('42, '45, '52, '54). This worker was the first to announce that fertilization consists of a physi-

cal influence of the spermatozoön upon the egg, such influence being at first limited to the germinal vesicle. In the rabbit he distinguished a large number of cleavage stages, while in the dog he made the fundamental observation that the egg at the time of heat lies in the Fallopian tube, ovulation being here independent of copulation. His studies on the egg of the guinea-pig established the fact that in this animal the eggs mature just after parturition. Only a few stages of the deer's egg were seen by Bischoff, but he found that the eggs in the Fallopian tube have their development arrested during the winter.

Reichert ('61) also studied the egg of the guinea-pig, and found, as Bischoff ('52) had observed, that while these animals are in heat immediately after parturition, ovulation takes place only after coitus.

Weil ('73) worked with rabbit's eggs, and found that these animals, like guinea-pigs, are in heat immediately after parturition. This observer was probably the first to perceive both the male and female pronucleus in a mammalian egg.

Van Beneden ('75) was the first investigator to undertake histological studies by systematically examining a large number of mammalian eggs. In the egg of the rabbit he noted the disappearance of the germinal vesicle and the formation of two polar bodies as essential maturation phenomena, and after an exhaustive investigation of fertilization processes, in the course of which he saw spermatozoa with their heads in the surface of the egg, he came to the conclusion that fertilization consisted of the mingling of the substance of the spermatozoön with the outer layer of cytoplasm. This statement is surprising in view of the fact that van Beneden observed both the male and the female pronucleus, their conjugation, and the cleavage nucleus, as well as numerous cleavage stages.

Hensen ('76) confirmed Bischoff's observation that in rabbits and guinea-pigs the animals are in heat immediately after parturition, but he found that ovulation does not always take place at this time. He saw living spermatozoa, and witnessed their passage through the zona pellucida.

In 1879, three investigators, Benecke, Eimer and Fries, published papers on the eggs of bats. They each found living spermatozoa in the uterus, and in some cases also in the Fallopian tube, while the animals were hibernating; but Benecke claimed that ovulation and fertilization take place in the spring of the year. After studying the eggs of certain bats, however, van Beneden and Julin ('80)

stated that the eggs leave the ovary during the winter (December to February) and are at once fertilized, but only begin to segment in March or April. These workers further found that each egg commonly formed three polar bodies, and they saw both pronuclei and a few early cleavage stages. Van Beneden ('99) has since continued his study of the bat's egg, and has noted all the important cleavage stages.

Van Beneden ('80) described some late stages in the development of the rabbit's egg, and also made the important observations that the female pronucleus comes from the germinal vesicle and that the chromatin of the polar bodies has the same origin.

Rein ('83), working with the eggs of rabbits and guinea-pigs, observed in the latter the pronuclei in different stages of development and conjugation, as van Beneden ('75) had previously described for the rabbit. He also discovered that the formation of both polar bodies takes place within the ovary, and mistakenly considered that the female pronucleus, as well, was formed there.

Flemming ('85) found in the rabbit some ovarian eggs which had extruded the first polar body,—an observation confirmed the same year by Bellonci.

Selenka ('86) described some eggs of the opossum, ranging from two- to eighteen-celled stages. They were found in the upper part of the uterus.

Heape ('86) worked on the egg of the European mole. He was unable to follow the formation of the polar bodies, but observed the two pronuclei, two- and four-celled stages, and the later cleavages up to the formation of the blastula.

Keibel ('88) has described a two-celled stage of the European hedgehog's egg.

The investigations which have yielded the most conclusive and extensive results, however, have been conducted upon the egg of the mouse,—an egg more favorable for detailed cytological study than that of almost any other mammal. The names connected with this work are those of Bellonci ('85), Tafani ('88, '89), Sobotta ('93, '94, '95, '99), and Gerlach (:06).

Bellonci states that, in the mouse, the first polar spindle is similar to that found in the eggs of invertebrates, and that it is formed from the germinal vesicle. He also saw some ovarian eggs accompanied by the first polar body, the latter possessing a distinct membrane and lying under the zona.

Tafani observed both the first and second maturation spindles, found first polar bodies associated with degenerating ovarian eggs,

and witnessed the formation of the second polar body (he found two associated with only one-fifth of the eggs). He also saw spermatozoa entering the substance of the egg, the two pronuclei, the first cleavage spindle, and the principal later cleavage stages.

Sobotta studied the egg of the mouse in great detail, from the end of the spireme through the cleavage stages. He found two polar bodies accompanying only one-tenth of the fertilized eggs, and assumed the suppression of the first polar spindle in the other nine-tenths of the eggs matured. When the first polar body did occur, he observed that it was extruded within the ovary. Further references to Sobotta's valuable work will be given in connection with the discussion of the results of the writer's personal investigations.

Gerlach has taken some preparations made at least as early as 1890, before the discovery of iron haematoxylin, and, after studying them has revived Tafani's theory that the presence of the single polar body, which he finds with three-quarters of the fertilized eggs, is due to the suppression of the second polar body, the second polar spindle degenerating within those eggs which are fertilized a comparatively long time after leaving the ovary.

Hennegny ('94) observed in the rat degenerating ovarian eggs which had extruded the first polar body,—an observation confirmed by the writer.

Assheton ('94) has reinvestigated the early stages of development of the rabbit, and seen stages extending from the union of the pronuclei through cleavage.

Hubrecht ('96) succeeded in getting some eggs of an insectivore, *Tupaja javanica*, and noted the two pronuclei, a two-celled stage, and the principal later cleavage stages. He found two polar bodies. This same investigator (:02) has the honor of being the only man who obtained the mature eggs of any primate. He both describes and figures from *Tarsius spectrum* an egg with first polar body and second polar spindle, three eggs with male and female pronuclei, two of which show two polar bodies, as well as two-, four-, eight-, and sixteen-celled stages, besides the principal later cleavages.

Van der Stricht (:01) finds in the eggs of a bat, *Vesperugo noctula*, that the first polar body is extruded within the ovary, while the second is formed only after the ovum has been discharged into the Fallopian tube. In his later papers (:05, :06) he notes a distinction in the form of chromosomes in the first and second polar spindles, and states that the first maturation spindle commonly appears in February or March, sometimes not until April, depending upon the temperature. Ovulation occurs some days or weeks later. Two

polar bodies are always formed, and the eggs leave the ovary with the first polar body and the second polar spindle fully formed.

Marshall and Jolly (:05) have determined that in the bitch ovulation occurs independent of copulation.

Rubaschkin (:05) finds that in the guinea-pig ovulation takes place a short time after parturition (not immediately after, as stated by both Bischoff ('52) and Reichert ('61)), and is independent of coitus. The first polar body and the second polar spindle are formed within the ovary. The second polar body is always formed after the egg is fertilized, the spermatozoön entering the egg in the lower part of the Fallopian tube or in the upper end of the uterus. Eggs which fail to be fertilized degenerate with the second polar spindle.

Heape (:05) has worked with rabbits, and finds that ovulation occurs about 10 hours after copulation, as stated by Barry ('39), but the eggs degenerate within the ovary if there is an insufficient supply of blood to that organ, or if the male is withheld during oestrus. According to this observer, maturation takes place about nine hours after copulation, two polar bodies being rapidly formed within the ovary. In this respect, the rabbit's egg is different from all other mammal eggs thus far studied. If the buck is withheld from the doe during several consecutive periods of oestrus, most, if not all, of the older, and many of the younger, follicles undergo degeneration, and this may result in more or less persistent sterility.

A survey of the literature therefore indicates that, while there are many variations as to the details of the process, all mammalian eggs which have been carefully studied (with the exception of that of the mouse alone) agree with those of practically all invertebrates in the formation of two polar bodies. As a result of the foregoing studies, the egg of the mouse, although subjected to more extensive examination than that of any other mammal, seems to stand out sharply as an aberrant type, in that it has been said to form but a single polar body in from 75 to 90 per cent. of the eggs observed.

With a view of determining the cytological nature of these apparently aberrant maturation processes, the writer has recently made further investigations on the egg of the white mouse, the results of which are described on the following pages.

II.—*The Egg of the Mouse.*

Material and Method.—To obtain the material for this series of investigations, the method used was as follows: During the active breeding season when the adult females, as a rule, are in heat every

21 days, a large number of male and female white mice were placed together in a suitable cage, and the females then examined at frequent intervals for signs of pregnancy. As soon as such indications appeared, those females were mated, and close watch was kept for litters of young. The females were killed at various stages of pregnancy, careful records being kept of the exact time of parturition. After being chloroformed the bodies were quickly opened, and the ovaries with the Fallopian tubes were cut out; while in some instances these parts were used for the examination of living eggs, in others they were at once placed in a killing fluid. The killing fluids used were strong and weak solutions of Flemming, corrosive acetic acid, picro-acetic acid, and Zenker's mixture.

For general work Zenker's mixture has given by far the best results, owing largely to the great rapidity with which it penetrates, and to its not blackening the tissues as do osmic mixtures. The strong solution of Flemming, and picro-acetic acid, are excellent for spindle fibers. Corrosive acetic acid gives fairly good results, while the weak solution of Flemming is decidedly unsatisfactory, owing to its poor penetration.

After being killed and dehydrated, the tissues were imbedded in paraffine and sectioned ·008^{mm} thick. The sections were then affixed to slides with Mayer's albumen, and stained, for preliminary study, fifty slides at a time, with Delafield's haematoxylin and orange G. This method of staining is a simple process, but is all that is necessary to enable one to examine a series for karyokinetic figures; when such were found the sections were decolorized with acid alcohol, and restained with Heidenhain's iron haematoxylin.

The technique of obtaining living eggs is very simple, and they were seen and studied by Tafani ('89), although he makes no mention of the method used to obtain them. A female mouse is killed at the time when ovulation is thought to have taken place, the ovary and Fallopian tube are removed from the body, placed upon a glass slide on the stage of a dissecting microscope, freed, as far as possible, from fat and connective tissue, and then gently teased up with fine needles until the eggs are seen to drop out. When found, the eggs can be transferred on the slide to the stage of a compound microscope for more detailed examination and study. Karyokinetic figures and nuclei can be brought out by the use of acetic-carmine.

The results obtained have been briefly stated in a preliminary paper (Kirkham :07), and a brief summary has appeared in *Science* (Coe and Kirkham, :07). The ovaries of every mouse examined during

the height of the breeding season contained some eggs in which the first polar body had been already extruded and in which the spindle for the second polar mitosis was fully formed. A majority of the same ovaries revealed ovarian eggs at the end of the spireme or with the first polar spindle. The eggs observed in the Fallopian tube fall into two main groups: those which had not been fertilized, and which therefore retained the second polar spindle,—some being accompanied by the first polar body, but more without it—and those which had been fertilized. The latter show the entering spermatozoön and the cleavage stages.

Breeding Season.—Most animals, including man, which live in an artificial environment where there is an abundant supply of food the year round, have lost the habit, so common among wild animals, of being in heat only during limited periods of each year, and are capable of coming into heat at any season. Among domesticated animals, the white mouse is a good example of this characteristic, and both Tafani ('89) and Sobotta ('95) have found that, if kept warm during the cold months, it breeds more or less freely at all times. Sobotta ('95), however, found that white mice breed most actively from the beginning of March to the end of September, and in most animals, wild as well as domesticated, the sexual season or seasons occur during the warm months. Thus, Rubaschkin (:05) has found guinea-pigs to be most active sexually during August, September, and the beginning of October; Keibel ('99) states that deer are in heat at the end of July and the beginning of August: Rein ('83) finds that the period of heat for rabbits extends (at Strassburg) from the end of March to the middle of July, and Eimer, Benecke, and Fries ('79) have determined that in bats the period of heat is in the autumn.

The period of gestation in the white mouse was put down by Tafani ('89) as about 20 days, while Sobotta ('95) has determined that it is just 21 days.

During the active breeding season, adult female white mice, as found by Sobotta ('95), are in heat a few hours after parturition, and the same is true of the guinea-pig, according to Rubaschkin (:05).

The ovary of the white mouse measures about 2^{mm} in diameter, is more or less spherical in shape, and is chiefly composed of large and small follicles, a mature follicle measuring about $.35^{mm}$ in diameter. A comparison of this organ in the rat and the cat shows that the ovaries of these animals are ovoid in shape, and measure $3x5^{mm}$ and $4x8^{mm}$, respectively.

The Mature Ovum.—The egg of the mouse is as small as any known mammalian egg. A living ovarian ovum, before the formation of the first maturation spindle, measures .08^{mm}, or a little less in diameter, and it contains a germinal vesicle with a diameter of .025^{mm}, while this germinal vesicle may in turn possess one or two nucleoli with diameters of .008^{mm}. Living eggs in the Fallopian tube, before cleavage, measure from .073 to 078^{mm} in diameter. Sobotta's statement that the egg of the mouse measures .059^{mm} in diameter is probably based upon his study of sections after the eggs had become shrunken through the action of the reagents used. The human egg, for comparison, is .165 to .170^{mm} in diameter, that of the cat measures .2^{mm}, or a little less, while the egg of the rabbit is .116^{mm} in diameter.

Figure 1.—Camera drawing of a living egg soon after its discharge into the Fallopian tube; showing the zona pellucida made up of an inner, thinner, and dense layer, and an outer, thicker, gelatinous layer. The cytoplasm of the egg is coarsely granular except at one spot, which indicates the position of the second polar spindle. This egg has not retained the first polar body. ×330.

The *zona pellucida* surrounding a tube egg in the mouse usually has a thickness of about .016^{mm}, but it may stretch out to .036^{mm}. It is made up of a denser inner layer, with a thickness of about .007^{mm}, which is all that appears around ovarian eggs, and an outer layer of less dense but perfectly homogeneous substance (Text-figs. 1–3). After being killed and dehydrated, the zona appears very much shrunken (Pl. VIII, fig. 16), which probably accounts for Sobotta's statement that the egg of the mouse is enveloped in the thinnest known mammalian zona pellucida, which has a thickness of .0012 to .0015^{mm}. In the mouse this membrane lacks the radical striations or canals which have given it the name of zona radiata.

When the egg of the mouse has grown to full size, the chromatin is scattered through the germinal vesicle, and from this stage to the prophases of the first maturation spindle no observations have been made on any mammalian egg ; hence it is not known whether there is a pairing of paternal and maternal chromosomes, such as occurs in the invertebrates.

First Polar Spindle (Pls. I-II, figs. 1-4, Text-fig. 4).—The observation of the prophases of the first maturation spindle is confined to the egg of the mouse, a few such stages having been seen by the writer (Pl. I, fig. 1). A small number of cases showed faint traces of the nuclear membrane, but more often this had entirely disap-

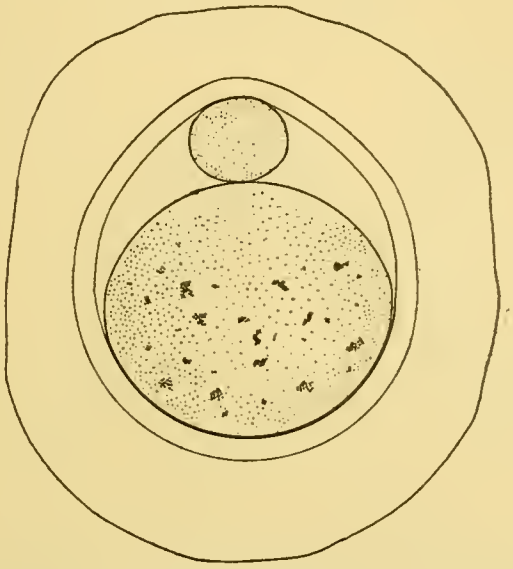

Figure 2.—Camera drawing of a living egg soon after its discharge into the Fallopian tube ; showing the two layers of the zona pellucida. The position of the second polar spindle within the egg is shown by the clearer area in the cytoplasm near the polar body. This egg has retained the first polar body, and a space filled with fluid appears around it. ×330.

peared. In this connection it is important to note that no asters such as are seen in eggs of invertebrates are visible at this time. The chromosomes at this stage vary greatly in size and shape, and they number between 12 and 24, which is probably due to precocious division. As shown in the figure, the germinal vesicle at the end of the spireme is eccentrically placed.

At what time the asters and centrioles make their appearance in the mammalian egg is not known, and their definite origin has not become well established even in the eggs of invertebrates. There is, therefore, a considerable gap between Pl. I, fig. 1, where there is no indication of any karyokinetic figure, and Pl. I, fig. 2, where a

fully formed spindle with the chromosomes in the equatorial plate is seen. Bellonci ('85) describes the first polar spindle in the eggs of mice and guinea-pigs as exactly like that found in the eggs of invertebrates, and he occasionally saw faint traces of aster-fibers at the ends of the spindle. The first polar spindle is formed from the germinal vesicle, which, as mentioned above, is eccentrically placed within the egg at the end of the spireme, and, as described by Sobotta ('95) in the egg of the mouse, and by Rubaschkin (:05) in the egg of the guinea-pig; this spindle lies at first in a position at right

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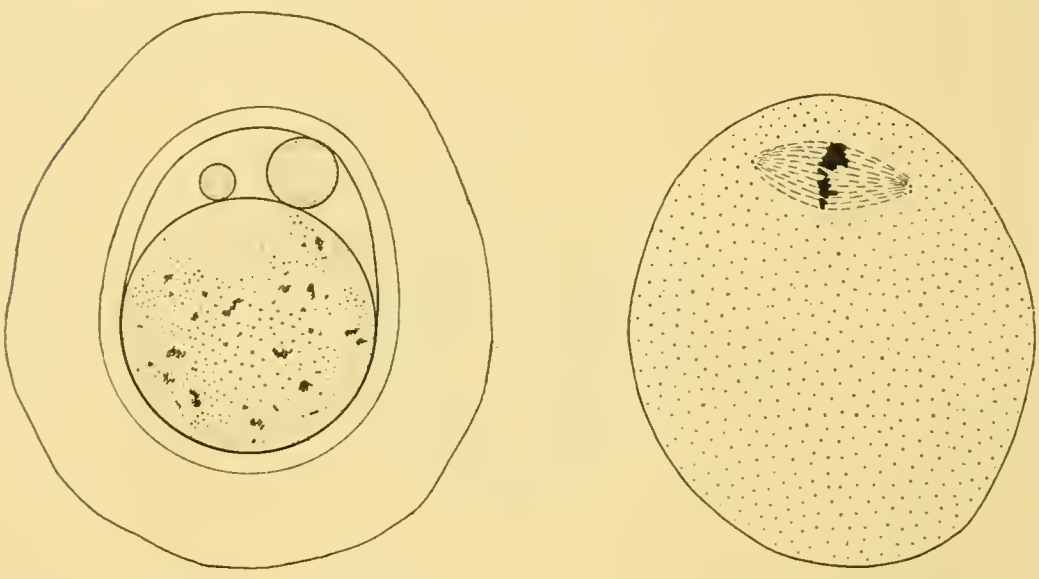

Figure 3.—Camera drawing of a living egg in the Fallopian tube soon after fertilization; showing the two differentiated layers of the zona pellucida. The finely granular portion of the egg indicates the position of the pronuclei. Both polar bodies have been retained by the egg, the larger one at the right being the first polar body; around them appears a space filled with fluid. ×330.

Figure 4.—Ovarian egg; showing first polar spindle in paratangential position. The chromosomes are in most instances bivalent. Note centrioles at foci of spindle. ×675.

angles to the radius of the egg, and near the surface. The chromosomes still vary greatly in size and shape, but are never filiform (Text-fig. 5), and generally lie with their long axes coincident with that of the spindle. The number of chromosomes in the first polar spindle agrees with that above noted at the end of the spireme, being between 12 and 24. At the foci of the first maturation spindle, centrioles consisting of one or more tiny eccentrically placed granules have often been observed, and similar bodies have been seen at this stage by van der Stricht (:06) in the eggs of *Vesperugo noctula*.

No radiations from these, however, such as have been described by Bellonci ('85) for the mouse egg and by van der Stricht (:06) for a bat's egg, have been seen by the writer. As might be expected from its larger chromatin content, this spindle is usually longer and broader than the second, a point noticed by Gerlach (:06), but it varies in size at different periods of development. The first maturation spindle is also larger than the second spindle in the eggs of most of the invertebrates.

After remaining for a time in the paratangential position, one pole of the first maturation spindle moves toward the center of the egg (Pl. II, fig. 4), as seen by Sobotta ('95), while the other presses against the outer surface of the egg. These movements are preparatory to the extrusion of the first polar body.

Figure 5.—Diagram of chromosomes in first polar spindle of the ovarian egg shown in Pl. I, fig. 2. On the right two large quadrivalent chromosomes are seen before splitting. To the left of these are three pairs of bivalent chromosomes, which have completely separated, while near the middle of the figure occurs another quadrivalent chromosome. At the left of the diagram are seen eight additional chromosomes differing greatly in size, while four more similar masses of chromatin appear in adjacent sections.

First Polar Body (Pl. III, figs. 5–6).—The first polar body in the egg of the mouse, as far as observed by the writer, is always formed within the ovary in every egg, which matures. A large number of eggs in different ovaries have been examined, and in every instance where the size of the egg, its slightly denser protoplasm, and the large follicle gave evidence of ripeness, the egg was found to be accompanied by the first polar body. This agrees with the observations of Bellonci ('85), and with Sobotta's idea regarding ten per cent. of the eggs, which he believed formed two polar bodies; it is also in accord with the work of van der Stricht (:01, :06) on the egg of *Vesperugo noctula*, and that of Rubaschkin (:05) on the egg of the guinea-pig.

In the mouse the first polar body is oval in form when seen in sections which have been killed and stained, but in life it is more apt

to be spherical (Text-figs. 2–3). It is larger than the second polar body, and commonly measures from .022 to .028^{mm} in diameter, although the limits of variation are sometimes much greater than these. Sobotta's statement that the first polar body in the mouse measures only from .002 to .003^{mm} in its larger diameter, is almost certainly based upon killed and stained material, while the figures here given are the average of a large number of measurements of living eggs. According to Rubaschkin (:05), the guinea-pig has polar bodies which measure from .012 to .017^{mm} in diameter, and the egg of this animal is practically of the same size as that of the mouse.

The chromatin content of the first polar body consists of a varying number of masses, most of which are undivided dyads, commonly scattered through the cytoplasm, but sometimes in a spindle (Pl. VII, fig. 15), as seen by Tafani ('89) and Sobotta ('95) in the

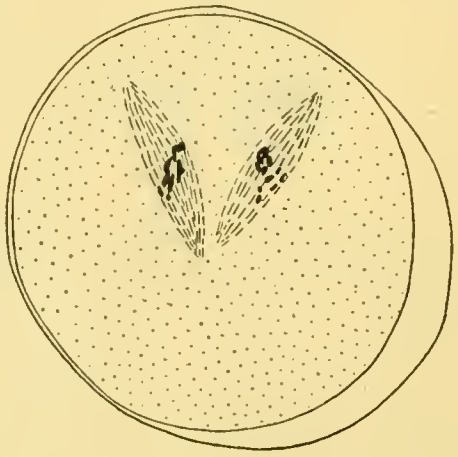

Figure 6.—Ovarian egg; showing abnormal tri-polar spindle. ×675.

egg of the mouse, by van der Stricht (:04) in a bat's egg, and by Rubaschkin (:05) in the egg of the guinea pig. Some of those polar bodies which possess fully formed spindles would probably have divided mitotically, and this is presumably the explanation of the three polar bodies commonly found by van Beneden and Julin ('80) accompanying bat's eggs. In Pl. IV, fig. 8, an egg is shown whose first polar body exhibits the telophase of mitosis; in Pl. IV, fig. 9, an example is given where the protoplasm of the polar body is beginning to divide.

The first polar body varies considerably in size in different eggs, and in one series of ovarian eggs there are two with first polar bodies of about four times the average volume (Pl. IV, fig. 7).

Two abnormal ovarian eggs have been seen (Text-figs. 6–7) bearing a striking resemblance to two observed by Rubaschkin (:05) in

the guinea-pig (figs. 5 and 7 of his paper). In one there is a tripolar spindle, and in the other two separate spindles, lying at opposite poles of the egg. The latter may be due to the fact that this egg possessed two nuclei. Still another abnormality is an egg (Text-fig. 8), which, from its position near the center of the ovary, is almost surely degenerating, whose first polar body has formed a resting nucleus. In all probability resting nuclei occur normally in the first polar body only in those very rare cases where the mitotic division is complete, and each part gathers its chromatin into such a form.

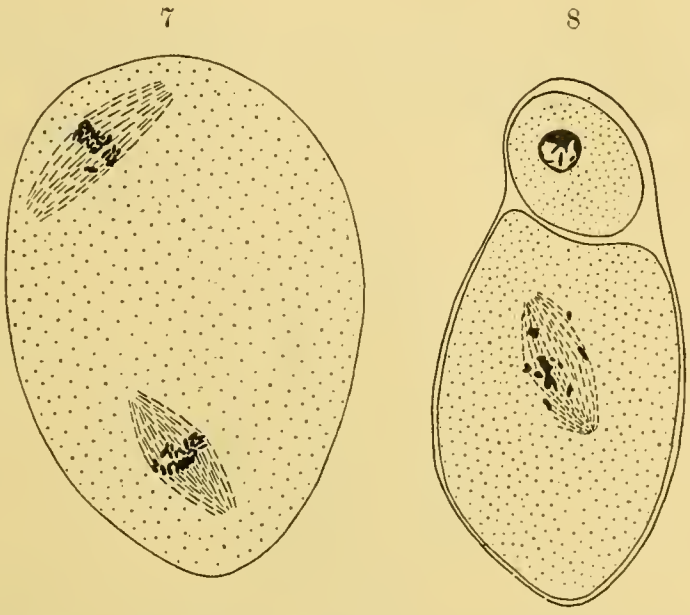

Figure 7.—Ovarian egg; showing two spindles,—an abnormal condition. This egg may have had two nuclei. × 675.

Figure 8.—Ovarian egg whose position in the interior of the ovary and the presence of its sister eggs in the Fallopian tube indicate a degenerate condition. Within the egg appear the second polar spindle, and above it the first polar body, with an abnormal resting nucleus. × 675.

Plate V, fig. 11, shows an ovarian egg which is unusual in that it has no zona pellucida, the egg and first polar body lying free in the liquor folliculi. This condition is probably due to the solvent action of the killing fluid, as mentioned by Rubaschkin (:05), since all the ovarian eggs in this series are likewise naked.

Second Polar Spindle (Pls. III–IV, figs. 5–9).—Immediately after the constricting off of the first polar body, the 12 dyads left in the egg are drawn into the equator of a new spindle, and split longitudinally. The second polar spindle is formed in a position at right angles to the radius of the egg, as described by Tafani ('89), and usually lies near the first polar body. It is smaller than the first

maturation spindle, as observed by Rubaschkin (:05) in the egg of the guinea pig, and by van der Stricht (:06) in the egg of *V. noctula*, but the determining characteristic is its chromatin content. The 24 univalent chromosomes (Text-fig. 9) resulting from the splitting lengthen out into filaments of various sizes, the form of which furnishes a certain means of distinguishing this spindle from the first polar spindle. These chromosomes sometimes lie with their axes parallel, but are generally perpendicular to that of the spindle, as noted by van der Stricht (:06) in the egg of *V. noctula*.

The achromatic fibers composing the second polar spindle usually come to a more or less sharp focus, where centrioles have commonly been observed, made up of one or more eccentrically placed granules. In a few instances radiating fibers have been seen by the writer at one, very rarely at both poles of this spindle (Pl. V, fig. 10).

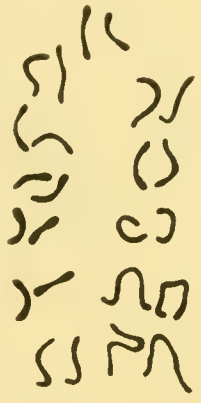

Figure 9.—Diagram of the twenty-four univalent chromosomes in the second polar spindle of the ovarian egg shown in Pl. IV, fig. 7.

Hubrecht (:02) has observed centrioles in the second maturation spindle of *Tarsius spectrum*, and van der Stricht (:06) has described both centrioles and aster fibers in both the maturation spindles of *V. noctula*.

A few ovarian eggs of the mouse show the first polar body at the opposite pole of egg from the second maturation spindle, as observed by Gerlach (:06), who interprets such cases by assuming that the spindle has moved about in the egg. This hypothesis, however, seems less probable than that the polar body has been moved around by pressure upon the zona, and an examination of a number of eggs similar to those shown by Gerlach (:06) in his fig. 18, has failed to reveal a single instance where the spindle does not lie at right angles to the radius of the egg; which fact hardly supports the migration theory.

When the egg of the mouse has extruded its first polar body and formed the second polar spindle, it normally never develops further unless it is fertilized, but degenerates either within the ovary or in the Fallopian tube, as stated by Sobotta ('95). According to Rubaschkin (:05), this is also the case in the guinea-pig's egg. These investigators further state that in the animals studied by them a considerable number of eggs reaching this stage fail to be discharged, owing to their position in the interior of the ovary. This condition has been also frequently observed in the mouse, by the present writer.

Ovulation.—It is an exceedingly rare thing to obtain a mammalian egg just leaving the ovary, but such have been figured by Barry ('39) for the rabbit; by Sobotta ('95) for the mouse; and by van der Stricht (:01) for *V. noctula*. Little is known regarding the factors concerned in ovulation, but the accumulation of fluid within the follicle probably plays an important part and, judging from the observations of Heape (:05) on rabbits, the presence of an abundant blood supply to the ovary is essential. In the mouse, during the active breeding period, the eggs leave both ovaries within an hour or two after parturition, independent of copulation; while in the rabbit, Barry ('39) and Heape (:05) agree that ovulation occurs only after coitus, and then after an interval of from 9 to 10 hours. According to Reichert ('61), the guinea-pig, like the rabbit, ovulates only after copulation, and the interval in this case is stated by Rubaschkin (:05) to be about 17 hours.

Fertilization.—According to Sobotta ('95) there is but a single copulation in the mouse. Normally only a single spermatozoön enters an egg. The tail of the spermatozoön usually enters the egg at least in part, and may be entirely carried in (Pl. VII, fig. 14), as observed by van der Stricht (:04) in the egg of *V. noctula*, and by Rubaschkin (:05) in that of the guinea-pig.

Second Polar Body (Pls. VI–VII, figs. 13–15; Text-fig. 3).—In the mouse, the second polar body is formed only by those eggs which are fertilized, as found by Sobotta ('95), and it appears very soon after the entrance of the spermatozoön. A similar condition has been observed in the guinea-pig by Rubaschkin (:05), except that in this animal the second polar body is not extruded until the sperm nucleus has penetrated deep into the egg. In Plate VII, fig. 14, is shown an egg in which the second polar body has been so recently extruded that the 12 univalent chromosomes are still visible. After a very short time these would have been collected into a more

or less solid mass (Pl. VII, fig. 15), and would have finally formed a resting nucleus (Pl. VIII, figs. 16–17, Text-fig. 10).

This second polar body is characterized by being generally spherical in form, with an average diameter of about .007 to .012^{mm}, and by containing 12 univalent chromosomes, which are usually seen either lumped together or as a resting nucleus. It is this polar body, furthermore, which is commonly found associated with the early cleavage stages (Pl. VIII, figs. 16–17).

The important question concerning the fate of the first polar body in cases where it has disappeared (Pl. VI, fig 12; Text-fig. 1) will now be considered. That this disappearance is not peculiar to the preparations used by the writer is established by the fact that eggs

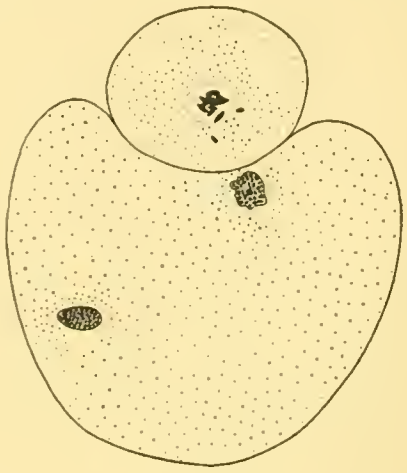

Figure 10.—Egg in the Fallopian tube soon after fertilization, with the second polar body, the chromatin of which is forming a resting nucleus. The first polar body has disappeared. At the right within the egg is seen the female pronucleus; at the left, the sperm head. The zona pellucida has been dissolved by the reagents used. (Somewhat diagrammatic.) ×675.

which possessed only a (second) polar spindle, no polar body accompanying them, were seen in the Fallopian tube by Tafani ('89), while Sobotta ('95) saw similar eggs, but mistook the spindle they contained for that of the first polar mitosis. Van der Stricht (:04), furthermore, has described and figured an egg of *V. noctula* with both polar bodies lying outside the zona. Finally, the writer has seen several series of living eggs before fertilization, in one of which only one egg in six possessed a first polar body, while in another series three out of the five eggs possessed this polar body.

The zona in the mouse may persist undiminished through the early cleavage stages of the egg, but in the guinea-pig Rubaschkin (:05) has found that at the time of ovulation the zona is soft, and

varies considerably in thickness in different eggs. A similar condition prevails in the mouse, so that at the time the eggs leave the ovary most of the first polar bodies are pressed through the zona. In fact, in a living egg possessing a first polar body, the writer has seen this polar body, while the egg was being stained and dehydrated on the stage of the microscope, forced through the zona by the contraction of the latter under the influence of changing osmotic conditions.

Pronuclei.—Immediately after the extrusion of the second polar body, the 12 univalent chromosomes remaining in the egg of the mouse assemble to form the female pronucleus (Pl. XIV), and the sperm head increases in size and approaches it. The male and female pronuclei now come to lie close together near the center of the egg, but somewhat nearer the animal than the vegetal pole, where they form the so-called cleavage nucleus.

Both the male and female pronucleus have been seen in the egg of the mouse by Tafani ('89), Sobotta ('95) and Gerlach (:06); in the rabbit's egg by Weil ('73), van Beneden ('75), and Rein ('83); in the guinea-pig by Rein ('83) and Rubaschkin (:05); in the egg of the bat by van Beneden and Julin ('80) and van Beneden ('99); in the mole's egg by Heape ('86); in the egg of *Tupaja javanica* by Hubrecht ('96), and in the egg of *Tarsius spectrum* by Hubrecht (:02).

The later fertilization stages as well as the entire process of cleavage and implantation have been described for the egg of the mouse by Sobotta ('93, '94, '95) and Burckhard (:01).

The writer welcomes this opportunity again to acknowledge his gratitude and indebtedness to Prof. Wesley R. Coe, whose encouragement and critical knowledge have been of the very greatest assistance in carrying on this work.

Sheffield Scientific School of Yale University.
May, 1907.

III.—*Summary.*

1. Two polar bodies are apparently formed by every egg which is capable of development, the first polar body appearing within the ovary, the second after the entrance of the spermatozoön into the egg.

2. At the breaking up of the spireme the number of chromatin masses is between twelve and twenty-four.

3. Twelve masses of chromatin are cast out with the first polar body, and a like number remain in the egg.

4. There is a sharp distinction in form between the chromosomes of the first and those of the second polar spindle.

5. Before fertilization, every egg in the Fallopian tube possesses a second polar spindle.

6. The zona pellucida, which is quite distinct, may persist, undiminished, through the early cleavage stages. In most cases the first polar body escapes from it during the process of ovulation, so that the majority of eggs after fertilization possess the second polar body only.

7. During the spring months ovulation usually occurs every 21 days within a few hours after parturition, and independent of copulation.

8. The number of univalent chromosomes in the second polar spindle is 24.

9. The second polar body is formed only after the egg has been fertilized.

10. The first and second polar bodies differ greatly in chromatin content, so that they are easily distinguishable. They also differ in size, and usually in shape.

11. At least the greater part of the sperm tail, if not the whole, enters the egg at the time of fertilization.

12. Since the egg of the monse forms two polar bodies, its maturation processes are in accord with those of the majority of metazoön eggs.

IV. BIBLIOGRAPHY.

Assheton, R.

'94. A reinvestigation into the early stages of development of the rabbit. Quart. Journ. Mic. Sc., Vol. 37.

Baer, K. E. von.

'28. Über Entwicklungsgeschichte der Thiere-Beobachtung und Reflexion. I. Königsberg.

'37. II. Königsberg.

Barry, M.

'38. Researches in Embryology. First Series. Phil. Trans. R. Soc. London.

'39. Second Series. Phil. Trans. R. Soc. London.

Bellonci, G.

'85. Del fuso direzionale e della formazione di un globulo polare nell' ovulo ovarico di alcuni mammiferi. Atti R. Accad. Linc. (4) Rendicont., Vol. 1, Fasc. 9.

Benecke, B.

'79. Ueber Reifung und Befruchtung des Eies bei den Fledermäusen. Zool. Anzeiger, Bd. II.

Beneden, E. van.

'75. La maturation de l'oeuf, la fécondation, et les premièrs phases du développement embryonnaire des mammifères d'après des recherches faites chez le Lapin. Communication préliminaire. Bull. d. L'Acad. R. d. Belgique, t. XL, No. 12.

'80. Recherches sur l'embryogénie des mammifères.— La formation des feuillets chez le Lapin. Arch. d. Biol., t. 1.

'99. Recherches sur les premiers stades du developpement du Murin (Vespertilio murinus). Anat. Anzeiger, Bd. 16.

—— and *Julin, Ch.*

'80. Observations sur la maturation, la fécondation et la segmentation de l'oeuf chez les Cheiroptères. Arch. d. Biol., t. 1.

Bischoff, H. L. W.

'42. Entwicklungsgeschichte des Kaninchencies. Braunschweig.

'42. Entwicklungsgeschichte des Menschen und der Säugethiere. Leipzig.

'45. *Entwicklungsgeschichte des Hundeeies. Braunschweig.

'52. *Entwicklungsgeschichte des Meerschweinchens. Giessen.

'54. *Entwicklungsgeschichte des Rehes. Giessen.

'66. *Neue Beobachtungen zur Entwicklungsgeschichte des Meerschweinchens. Abhandl. d. K. Bayr. Akad., München.

'84. *Beweis der von der Regattung unabhängigen periodischen Reifung und Loslösung der Eier der Saugethiere und des Menschen als der ersten Bedingung ihrer Fortpflanzung. Giessen.

Burckhard, G.

:01. Die Implantation des Eies der Maus in die Uterusschleimhaut und die Umbildung derselben zur Decidua. Arch. f. Mikr. Anat., Bd. 57.

Coe, W. R., and *Kirkham, W. B.*

:07. The Maturation of the Mouse Egg. Science, Vol. XXV.

Cruikshank, W.

1797. Experiments in which, on the third Day after Impregnation, the Ova of Rabbits were found in the Fallopian Tubes ; and on the fourth day after Impregnation in the Uterus itself ; with the first Appearances of the Foetus. Phil. Trans. R. Soc. London.

Eimer, Th.

'79. Ueber die Fortpflanzung der Fledermäuse. Zool. Anzeiger, Bd. II.

Flemming, W.

'85. Ueber die Bilding von Richtungsfiguren im Saugethierei beim Untergang Graaf'scher Follikel. Arch. f. Anat. u. Physiol. Anat. Abtheil.

Fries, S.

'79. *Ueber die Fortpflanzung der einheimischen Chiropteren. Göttinger Nachrichten.

---

* Cited from Sobotta ('95) ; † cited from Nagel, Das menschliche Ei. Arch. f. Mikr. Anat., Bd. 31 ('98) ; ‡ cited from Zool. Jahr. ('99).

Gerlach, L.

:06. Ueber die Bildung der Richtungskörper bei Mus musculus. Bergmann, Wiesbaden.

Graaf, R. de

1678. †Opera Omnia. Lugduni Batayiae.

Heape, W.

'86. The Development of the Mole (Talpa Europea), the Ovarian Ovum and Segmentation of the Ovum. Quart. Jour. Mic. Sc., Vol. XXVI, 2.

:05. Ovulation and Degeneration of Ova in the Rabbit. Proc. R. Soc. London, Vol. 76 B.

Henneguy, L. F.

'94. *Recherches sur les follicules de Graaf chez les mammifères et quelques autres Vertébrés. Journ. d. Anat. et d. Physiol., Ann XXX, No. 1.

Hensen, V. von

'76. Beobachtungen über die Befruchtung und Entwicklung des Kaninchens und Meerschweinchens. Zeit. f. Anat. u. Entwick., Bd. 1.

Hubrecht, A. A. W.

'96. Die Phylogenie des Amnions und die Bedeutung des Trophoblastes. Verhandel. d. K. Akad. van Wetensschappen (2e Ser.), Bd. 4, p. 5.

:02. Furchung und Keimblattbildung bei Tarsius spectrum. Verh. d. K. Akad. van Wetenschappen (2e Ser.), Bd. 8, p. 6.

Keibel, F.

'88. Zur Entwicklungsgeschichte des Igels (Erinaceus europaeus). Vorläufige Mitthlg. Anat. Anzeiger, Jahrg. III.

'99. ‡Zur Entwicklungsgeschichte des Rehes. Anat. Ges. Vers. 13.

Kirkham, W. B.

:07. The Maturation of the Mouse Egg. Biol. Bull., Vol. 12, No. 4.

Lane-Clapon, Janet E.

:06. On the Origin and Life History of the Interstitial Cells of the Ovary in the Rabbit. Proc. R. Soc. London, Vol. 77 B.

Marshall, F. H. A., and *Jolly, W. A.*

:05. The Oestrous Cycle in the Dog. Proc. R. Soc. London, Vol. 76 B.

Rabl, H.

'99. Mehrkernige Eizellen und mehreiige Follikel. Arch. f. Mikr. Anat., Bd. 54.

Reichert, C. B.

'61. *Beiträge zur Entwicklungsgeschichte des Meerschweinchens. Abhandl d. K. Preuss. Akad. d. Wissenschaften.

Rein, G.

'83. Beiträge zur Kentniss der Reifungserscheinungen und Befruchtungsvorgänge am Säugethierei. Arch. f. Mikr. Anat., Bd. 22.

Rubaschkin, W.

:05. Über die Reifungs- und Befruchtungs-processe des Meerschweincheneies. Anat. Heft., Bd. 29.

Selenka, E.

'86. Studien über Entwicklungsgeschichte der Thiere. 4H. Das Opossum. Wiesbaden.

Sobotta, J.

'93. Mittheilungen über die Vorgänge bei der Reifung, Befruchtung und Furchung des Eies der Maus. Verhandl. d. Anat. Ges. Vers. 7.

'94. Die Befruchtung des Eies der Maus. Anat. Anzeiger, Bd. IX.

'95. Die Befruchtung und Furchung des Eies der Maus. Arch. f. Mikr. Anat., Bd. 45.

'99. ‡Über die Bedeutung der mitotischen Figuren in den Eierstockseiern der Saugethiere. Ein Beitrag zur Kenntnis der ersten Richtungsspindel der Säugethiere. Festschr. Physik. Med. Ges. Wurzburg.

Stricht, O. van der.

:01. La Pont Ovarique et l'Histogenèse du Corps Jaune. Bull. d. Acad. R. d. Med. d. Belgique.

:04. Une anomalie très intéressante concernant le Développement d'un Oeuf de Mammifère. Ann. d. Soc. d. Med. d. Gand, Vol. LXXXIV.

:05. La Structure de l'Oeuf de Chauve-souris (V. noctula). C. R. Ass. Anat., t. 7.

:06. Les Mitoses de Maturation de l'Oeuf de Chauve-souris (V. noctula). C. R. Ass. Anat., t. 8.

Tafani, A.

'88. *La fecondazione e la segmetazione studiate nella nova dei Topi. Accad. Med.-fisic. Fiorent.

'89. *I primi momenti dello svilluppo dei mammiferi. Studi di morphologia normale e patologica eseguita nella nova dei Topi. Atti. d. R. Instit. d. Stud. Prat. e. d. Perfezion in Firenze.

'89. La fécondation et la segmentation étudiées dans les oeufs des rats. Arch. Ital. d. Biol., t. XI.

Weit, C.

'73. Beiträge zur Kenntniss der Befruchtung und Entwicklung des Kaninchencies. Wiener Med. Jahrbücher.

EXPLANATION OF PLATES.

Figures 1, 2, 3, 5, 8, 11 and 13 represent single sections, while the others have been reconstructed from two or more sections. All the figures have been drawn with the aid of an Abbe-Zeiss camera lucida and a Zeiss apochromatic 2·0^{mm}. apert 1·30 homog. immers. objective, using for the figures magnified 560 diam. a Zeiss Compens. Ocular 4, and for those magnified 1450 diam. a Zeiss Compens. Ocular 6.

Plate I.

Figure 1.—Ovarian egg before the formation of the first polar spindle. Note difference in size and shape of the chromosomes. A portion of the nuclear membrane is still visible. × 1450.

Figure 2.—Egg in Graafian follicle, somewhat shrunken away from the zona pellucida, showing first polar spindle. Note difference in size and shape of chromosomes. × 560.

PLATE II.

Figure 3.—Ovarian egg; showing first polar spindle in paratangential position. A minute centriole appears at the right-hand pole of the spindle, while three similar bodies are visible at the opposite focus. The chromosomes are typical tetrads. × 1450.

Figure 4.—Ovarian egg; showing a first polar spindle in a position approaching radial. × 1450.

PLATE III.

Figure 5.—Egg in Graafian follicle; showing first polar body and second polar spindle. × 560.

Figure 6.—Same egg at greater magnification. Seventeen masses of chromatin, some of which are undivided dyads, are scattered through the first polar body among traces of spindle fibers; twenty-four univalent chromosomes appear in the equatorial plate of the second polar spindle. Certain chromosomes have been added from adjacent sections. Minute centrioles appear at each pole of the second spindle. × 1450.

PLATE IV.

Figure 7.—Ovarian egg; showing second polar spindle and an abnormally large first polar body. Note spindle in polar body, and twenty-four filiform, univalent chromosomes in the egg. × 1450.

Figure 8.—Ovarian egg; showing first polar body and second polar spindle. Two minute centrioles appear at each pole of the second spindle. The chromatin in the polar body is at the telophase of mitotic division. × 1450.

Figure 9.—Portion of ovarian egg; showing first polar body. Note constriction in middle of polar body, the beginning of the final step in mitotic division. × 1450.

PLATE V.

Figure 10.—Ovarian egg; showing second polar spindle. First polar body omitted. Note radiating fibers at inner pole of spindle, and lateral fibers at outer end. (The position of the spindle in the egg is slightly diagrammatic.) × 1450.

Figure 11.—Egg in Graafian follicle, in which the zona has disappeared, probably through the solvent action of reagents. Egg and polar body have separated from coronal cells, and lie free in liquor folliculi. Second polar spindle is visible near the periphery of the egg. × 560.

PLATE VI.

Figure 12.—Egg in Fallopian tube; showing second polar spindle. First polar body has disappeared. Egg has not yet been fertilized. × 1450.

Figure 13.—Two eggs in Fallopian tube, surrounded by cells of the membrana granulosa. Note the nearness of the eggs to each other. Upper egg shows the female pronucleus. Lower egg shows two typical polar bodies. The greater part of the chromatin of the first polar body is in adjacent sections, But it all appears as separate chromosomes, while that in the second polar body is collected into a fairly solid mass. Note the ragged and imperfect zona pellucida, a condition due in part to the solvent action of reagents. × 560.

PLATE VII.

Figure 14.—Egg in Fallopian tube ; showing second polar body before its twelve univalent chromosomes have been gathered into a solid mass. First polar body has disappeared. At left, within the egg, is seen the sperm nucleus, and above it the separated tail of the spermatozoön ; at right appears the egg nucleus, surrounded by delicate radiating fibers. The complete absence of the zona pellucida is in part accounted for by the solvent action of the reagents. × 1450.

Figure 15.—Egg in Fallopian tube ; showing both polar bodies, with their typical differences. Note oval first polar body with its twenty-four univalent chromosomes in a spindle, and the round second polar body with its compact mass of chromatin. The sperm head appears at the left, the female pronucleus at the right within the egg. The complete absence of the zona pellucida is in part attributable to the solvent action of the reagents. × 1450.

PLATE VIII.

Figure 16.—Egg in Fallopian tube ; showing first cleavage spindle and second polar body with a resting nucleus. First polar body has disappeared. Note length, and bent form of cleavage chromosomes ; also the distinct centriole at each pole of the cleavage spindle. × 1450.

Figure 17.—Egg in Fallopian tube ; showing two-celled stage. First polar body has disappeared; the second appears above and between the two blastomeres. × 1450.

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POÉSIES DE "MAISTRE ELOY DU MONT, DICT COSTENTIN."

BY

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IV.—Poésies de "Maistre Eloy du Mont, dict Costentin."

By David Hobart Carnahan, Ph.D.

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INTRODUCTION.

The above-mentioned work, which is contained in manuscript 2237 f, fr., of the National Library at Paris, was called to my attention by Monsieur Emile Picot in response to a request for information concerning Eloy du Mont, the author of a short mystery of

"La Résurrection." The contents of the manuscript seemed to make it worthy of attention, as it contains not only various forms of poetry common to the beginning of the sixteenth century but also one hundred of the Latin distichs of Faust Andrelin, poet laureate of Louis XII. Each of these Latin distichs is translated into a French distich and is accompanied by from one to four French maxims, or so-called "appendices," which are based on the Latin distich.

The manuscript is described as follows in the catalogue of the manuscripts of the National Library: "Manuscrit 2237, Poésies de "maistre Eloy du Mont, dict Costentin" commençant par,

> "Le Redempteur, Françoys, roy tres chrestien
> "Vous a promis au ciel saturité———"

et finissant par:

> "Par mort cruelle, en attendant la fin,
> "Que du bon roy nature soit contente."

Le recueil comprend dizains, chant royal, rondeau, cent distiques[1] de "Faust Andrelin," traduits par "Costentin," avec dédicace, ballades et quelques autres petites pièces françaises et latines . . . . Jacobi Galli hexastichon, (fol. 43) "carmen" in translationem distichorum faustinorum in linguam franciscam." Velin, miniatures, lettres ornées, seizième siècle. (Anc. 8012.)"

The following facts should be added to this description: The manuscript contains forty-nine leaves of parchment and five fly-leaves of paper. On the first fly-leaf are found the words, "Z68 Costentin serf du Roy. Faust Andrelin." The first two leaves of parchment are blank. The writing begins on the verse of the third leaf of parchment. On the recto of this leaf has been written the following date MCCCCLXXXVIII. The leaves are $8\frac{3}{4}\times6\frac{1}{2}$ inches, the lines in one column, with twenty-two lines to a page. Manuscript in good condition, and handwriting clear. The rubrics are in red, with two exceptions which are in blue. Capitals of each verse black with gold shading except fol. iv, where they are entirely gold.

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[1] Eloy du Mont gives this number (fol. 10, recto); in reality, there are one hundred and six. The author, in three places, counts two Latin distichs written on the same subject as one distich. We find six pairs thus treated; 18–19, 22–23, 28–29, 42–43, 60–61, 88–89. If we count each of these pairs as a single distich, we have the one hundred distichs of which he speaks.

Numerous large initials with flowered tracing. Three miniatures in colors. Manuscript written entirely in the same handwriting. The manuscript of the National Library is the only one existing.

We have little exact information in regard to Eloy du Mont, the author of the "Poésies." To his pen is also due the mystery of the "Résurrection,"[1] which is an abridgment of the long mystery of the same name attributed by M. Petit de Julleville to Jean Michel.[2] M. Petit de Julleville gives the date of this abridged mystery as towards the year 1530, on account of the references in the dedicatory epistle to the rigors employed by the king against the heretics.[3] It might well be dated any time from 1530 to 1536, as these severe measures were practised against the Protestants continuously during these years.[4] The references, moreover, are quite vague in respect to date, as one may see ; fol. 2, recto, line 5, "Si de par vous remede on n'y eust mys," and lines 10–11, "la bonne justice Qui faict en est par vous, donne notice." A probable date for the representation of this mystery would be 1532, when the king passed through Normandy on his way to the coronation of his son Francis, as Duke of Brittany. In the dedicatory poem of his "Poésies," Eloy du Mont speaks of a present made to him at Vasteville in the name of the king ; there may be confusion in the manuscript between the name of this town and Vatteville, where Francis passed the fourth and fifth of March, 1538.[5]

The few details in the life of our author with which we are acquainted are furnished by two of his works, which have come down to us. In "La Résurrection," he styles himself, simply, "Costentin, du Roy serf loyal (fol. 2, verso), Maistre Eloy du Mont, dict Costentin (fol. 10, recto.), Aeligii Montani Constantinatis (fol. 10, recto.), Costentin, vostre humble vallet (fol. 11, verso)." The term "valet du Roy" may imply nobility of rank but does not necessarily do so, as there are instances of writers who are not of noble birth being in attendance upon royalty. If of noble rank, the name of Costentin would point to the house of Costentin-Tourville in Normandy, but, unfortunately, a study of the genealogy of this family reveals no one who may answer to his description. The

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[1] Manuscript B. N., 2238, f. fr.

[2] See "Note sur le Mystère de la Résurrection attribué à Jean Michel." G. Macon. Paris, 1898.

[3] Les Mystères, vol. i, p. 336.

[4] See "Le Journal d'un Bourgeois de Paris," p. 169 et seq.

[5] Catalogue des Actes de François I, tome II, mars, 1538.

expression "humble valet" which is used above may well be taken in the sense of "humble servant."

In searching in Normandy for writers who lived in the period under discussion, one's attention is at once drawn to Eloy d'Amerval, the author of "La Grande Déablerie." A comparison of the places of residence and periods of activity, however, of this writer and of Eloy du Mont shows the improbability of the two being identical. "La Grande Déablerie" was printed in 1508, and contains a "privilège" which implies that the author, at that time, was advanced in years: "De Maître Eloy d'Amerval, sans doubtance, Vénérable Prestre, plein de prudence." Both the known productions of our author are in the third decade of the sixteenth century. We know, from the authority of Du Verdier,[1] and from Parfaict[2] that Eloy d'Amerval was a priest in the village church at Béthune; Eloy du Mont, from his own statement, lived in Caen, and he was not a priest, because in the dedication of "La Résurrection" (fol. 2, verso, line 14), he mentions his wife.

Eloy du Mont was a teacher in Caen, where he speaks of teaching his "petitz escoliers," and in his poems, announces the fact that the "Poésies" are "Non composéz de jacobins ou carmes Mais d'escolliers, domesticques amys." The term "petitz escoliers" leads one to believe that he was not an instructor in the University of Caen but in a school of lower grade. Furthermore, an examination of the departmental archives of Calvados does not show his name on the University roll.[3]

Our manuscript is not dated, but from evidence furnished by the text we conclude that it was written towards the end of the third decade of the sixteenth century. In the "Dizain de France et Italie" (fol. 47, recto), we find the following personal reference:

> Italiens ont moult France ennoblie
> De deux grandz biens, de la langue latine,
> D'un aultre bien qui vault qu'on ne l'oublie,
> C'est de la sage et tresnoble daulphine.

Catherine de Medicis married Henry II in 1533, but Henry did not become "dauphin" until the death of his older brother Francis, in 1536. Three passages which we find imply that the "Poésies" were written in times of peace; fol. 1, verso (I):

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[1] Du Verdier Bibl. fr. II. p. 325.

[2] Parfaict Frères, Hist. du th. fr., II, p. 219.

[3] Archives départmentales, Calvados. Série D, Université de Caen.

Parfaict en France est l'escript propheticque,
Justice et Paix se baisent au dict lieu.
(II) Justice, Iniquité corrompt,
Et Paix a Guerre le col romp,

fol. 10, recto (XI); "Franci, Francisco, felices pace fruuntur." The third war between Francis I and Charles V lasted from 1536 until the truce of Nice in 1538, after which ensued a peace of four years duration. If we give weight to the above rather uncertain references, the present work was written between the years 1538 and 1542.

By way of summary, and with the addition of a few facts obtained from the text, we may say that the work under consideration was written about 1538 by Eloy du Mont, a layman living in the city of Caen. He was a teacher in a boys' school, and was assisted in the production of his text by several of his pupils. The work was dedicated to the king Francis I, in recognition of a gift made to the author, possibly as a reward for the production of the mystery of "La Résurrection," represented during one of the king's trips to Normandy. The poet was skilled in Latin, but if we may judge from his own statements, he preferred writing in French, a language in whose poetical forms he was well versed, and which was more popular at court than the Latin.[1]

Much more accessible is information as to the life of Faust Andrelin, whose Latin distichs, together with their translations and appendices, occupy twenty-seven folios of the manuscript. In the "Dictionaire historique" of Moréri is found the following biography, to which I have joined, in the form of notes, a few additional facts obtained from the "Bibliothèque françoise" of Du Verdier:— Andrelinus (Publius Faustus), natif de Forli en Italie, excella dans la poésie dès sa jeunesse, et mérita à l'âge de vingt-deux ans la couronne de laurier, que l'académie de Rome donnoit à ceux qui avoient rèussi. Ce fut sa pièce poétique, intitulée "Livia" qui remporta ce prix. Il vint à Paris, où il fut long-temps professeur en poésie, en rhétorique, et en sphère dans l'université, sous les regnes de Charles VIII et de Louis XII.[2] Il y publia en 1490 son

[1] See "Les Poésies," fol. 12, verso, and "La Résurrection," folios 1, recto and 2, verso).

[2] Du Verdier, I, p. 567; Le Roi. Louis XII, en conséquence d'un voeu qu'il fit à la sainte Hostie de Dijon, pendant une maladie qu'il eut, en 1505, ayant recouvré sa santé, envoya, en reconnoissance, à la Chapelle Royale, où cette Hostie est conservée, la propre Couronne, qu'il avoit portée à Reims, le jour de son Sacre; sur quoi Fauste ayant fait douze vers Elégiaques, le Roi lui donna, pour récompense, un Canonicat à Bayeux. (M. de la Monnoye.)

poème divisé en quatre livres, intitulé Livia, du nom de sa maîtresse, et ensuite trois livres d'élégies. Après avoir pris la qualité de poète couronné, il prit celle de "poèta regius et reginaeus," poète du roi Louis XII, et de la reine Anne de Bretagne. Il y a encore douze églogues de lui, imprimées en 1546. Il ne s'est pas contenté de faire des vers, il a aussi écrit en prose des lettres morales et proverbiales, dont on a fait une édition à Strasbourg en 1517 ; Beatus Rhenanus y a joint une préface, dans laquelle il les loue excessivement. Ces lettres ont été augmentées par Jean Arboreus, théologien de Paris.

Quelques-unes des poésies d'Andrelinus ont été traduites en françois par un poète de Paris, qui s'appelloit Estienne Privé. Cette traduction qui parut l'an 1604, n'est propre qu'à faire mépriser l'original. Jean Paradin[1] avoit déjà mis en françois une centaine des distiques qu'Andrelinus avoit dédiés à Jean Ruzé, trésorier des finances de Charles VIII.[2] Les poésies d'Andrelinus ont été insérées dans le premier tome des "Délices des poètes Italiens." On a jugé assez différemment. Il faisoit des vers avec beaucoup de facilité ; les termes en sont magnifiques, mais ils sont vuides de sens. Il mourut pendant l'hiver de 1519, avant pâque, c'est-à-dire 1519, suivant le calcul romain.

Eloy du Mont is a careful writer in comparison to the other poets of his time ; his ballads, rondeaus and other poetical compositions are all regular in construction and his versification is correct. The examples of verse which are found in this collection are valuable in the study of the poetry of the sixteenth century on account of the evident exactness of his views in regard to the rules of composition, and the consistency with which he adheres to them. The following kinds of French poetry are found in the manuscript :

1. Six dizains, 10-syll. Four have the rime-order (ababccdede), and two (ababbccded).

2. Three ballads, 8-syll., 8-8-8-4, (ababbcbc), (abab). In two of the ballads, the initial letters of the lines form the words, "François de Valois."

[1] Du Verdier, II, p. 487 : Jean Paradin, de Louhans, a écrit en rime, un Livre intitulé Micropédie, contenant cent Quatrains, qui font les cent distiques de Fauste : Dialogues, etc.—le tout imprimé à Lyon, in-8°, par Jean de Tournes, 1546, et à Paris, in-16°, par Estienne Groulleau, 1547.

[2] Du Verdier, I. p. 567 :—La traduction de Paradin, est plutôt une Paraphrase, qu'une Traduction . . . . Etienne Privé s'est assujetti à rendre les Distiques vers pour vers, au lieu que Paradin les a rendus par Quatrains. La Traduction d'Estienne Privé, quoique plus précise, n'est pas plus estimée que celle de Paradin. Voy. la Bibliothèque Françoise de M. L'Abbé Goujet, tome VIII, p. 15 et la Bibliothèque Curieuse de Clément, tome I, p. 322.

3. Three rondeaus, 10-syll., 5-3-5 (aabba), (aab), (aabba). The words which begin line one are repeated after lines eight and thirteen.

4. One huitain, 8-syll. "Rimes plates."

5. One chant royal ("Champ Royal"), 10-syll. Five stanzas, of eleven lines each, with an envoy of six lines (ababbccdede), (aababa). Refrain, "Le Champ Royal en troys liz d'or planté."

6. One "oraison," 8-syll. Eight stanzas (abab), except stanza IV (aabb).

7. Two quatrains, 8-syll. (aabb).

Miscellaneous French poetry:

1. Translation of the Latin poem, "Aenigma de lilio." Forty lines, 10-syll. "Rimes plates."

2. Dedication to the king. One hundred and forty-two lines, 10-syll. "Rimes plates."

3. Dialogue, "Roy, Charité, Foy, Hérétique, Dyable. Each speaker has two lines. "Rimes plates," 8-syll.

4. Appendices to the Latin distichs. One hundred and sixty-five French distichs, 10-syll.[1]

"Rime riche" is used almost entirely by the poet, and the examples of leonine rime are very abundant. There are many cases of overflow verse. From the large number of "rimes équivoques," it is evident that the author endeavored to use them as frequently as possible. Some of the most striking of these rimes are: (1, verso), *maintient* : la *main tient*, prophetie *davidique* : *david dict que*, *corrompt* : le *col rompt;* (7, verso), je *devaloys* : François *de Valoys*, *soubz France* : *souffrance*, *ma part tient* : m'*appartient;* (11, verso), humb*le vallet* : *le valloit*, *aulx dieux* : *odieux*, lesqueil*z avez* : *scavez*, (14, verso), *amys* : *a mys*, *avant age* : d'*avantage*, *rondeaulx* : *rondz d'eaulz;* (18, verso), *amer* : l'*amer;* (23, recto), d'*envie* : *en vie;* (36, recto), *le corbeau* : *le corps beau;* (45, verso), *parler* : *par l'air*.

The following rimes are of interest from the point of view of pronunciation: (3, recto), ateste: texte, dextre : croistre; (3, verso), droicte : extraicte; (3, recto), congnoistre : dextre; (5, verso), estre : paroestre; (7, verso), monde : habunde, regne : Royne; (9, recto), vouloir : voller; (11, verso), memoire : encore, parler : vouloir; (42, verso), ceptre : dextre; (45, verso), parler: par l'air, valletz : valoys.

(Syllabification.) Our author, the same as the other writers of his time, employs various forms of hiatus which are forbidden by modern rules. He differs from many of his contemporaries, however,

[1] For the titles of the Latin selections, see the table of contents, p. 89.

in the fact that when he accepts a certain syllable-value for a combination of vowels, he does not change this value to meet the exigencies of the verse. As a consequence of this exactness of usage, the definite syllable-value of certain groups of vowels is clear. In his lines of ten syllables, he uses the "césure ordinaire,"[1] and in the forty cases in which we find the feminine cesura, with the fourth syllable of the line accented, the following word begins with a vowel. No examples of lyric cesura are found.

A few of the questions to be considered in a study of the manner of counting syllables at this epoch, may be illustrated by examples from these poems :

1. Hiatus. Frequent, with no cases of synalepha : planta en (2, verso), ordonné a (2, verso), clergé et (4, recto), Flora et (9, verso), beaulté admirable (9, verso), macquereau est (19, verso), volupté est (21, recto), volupte incline (25, verso), nommé en (12, recto), à en (16, verso), a on (18, recto).

2. Final mute e, followed by a word which begins with a vowel, never counts as a syllable, although, in a few cases, the elision is not indicated, as : Que a (11, verso), Je imploreray (13, verso), que ung (14, recto). Sometimes the elision is graphically represented by raising the "e" above the line and closing the gap.

3. Final "es," followed by a word which begins with a vowel, counts as a separate syllable ; estes en, 3-syll. (13, recto), Princes et, 3-syll. (14, recto), fleuves y, 3-syll. (18, recto), tumbes au, 3-syll. (21, recto), lignes et, 3-syll. (42, recto).

4. The verbal ending "oient" counts as one syllable ; auroient (4, recto), croiroient (7, recto), excedoient (9, recto), soient (13, verso).

5. The ending "ier," in verbs, counts as two syllables ; otherwise, as one syllable. Ex.: two syllables, attedier (12, verso), dedier (12, verso), marier (29, recto); one syllable, ouvrier (3, recto), familiers (12, recto), louvrier (13, verso), descolliers (14, verso), entier (16, verso), mestier (16, verso).

6. Final "ieux" counts as one syllable in the stem of a word, but as two syllables in the ending. Ex.: one syllable in mieulx (1, verso), lieu (2, verso), Dieu (2, verso) ; two syllables in spacieux (2, verso), gratieuse (9, verso), furieux (38, recto). In rime-words, we find: trespreci*eux* (2-syll.): *cieulx* (1-syll.); D*ieu* (1 syll.): odi*eux* (2- syll.).

7. Final "ion" counts as two syllables ; nation (3, recto), donation (3, recto), region (44, verso).

[1] See A. Tobler, "Le Vers français, ancien et moderne," p. 112.

8. The group "ien" counts as one syllable in: treschretien (1, verso), convient (4, recto), combien (9, recto), entretiendra (37, verso), tient (41, recto), souvienne (47, recto); as two syllables in chrestienté (3, verso), anciens (15, verso), Venitiens (25, recto), science (33, verso), Italiens (47, verso), terriens (38, verso), l'impatient (24, verso).

9. The word "je," as enclitic, counts as a separate syllable unless followed by a word beginning with a vowel, in which case it is elided. Ex.: prendray je (13, verso), Dis je (13, verso), doy je estre (5, verso), ay je encore (11, verso).

10. The group "ou" + "i" or "e" counts as two syllables; "u" + "i" counts as one. Ex.: ouyr (33, verso), louenge (5, verso), nuyr (9, recto), fuyront (23, verso).

11. The following count as one syllable: c*iel*, d*ya*ble, requ*iert*, v*iel*lesse, v*iei*l, superfl*uité*, amit*ié*, par*oe*stre, *oe*siveté, lum*iere*, man*suetude* (4, recto), but mans*ietude*, 2-syll. (38, verso).

12. The following count as two syllables: lil*ial*, insat*iable*, trouv*ee*, obv*iant*, her*oieques*, p*oete*, eig*ue*, mar*iage*, p*ays*.

I.

Dizain envoyé au Roy par Justice et Paix.

(1, verso)

Le Redempteur, (Françoys, Roy treschretien),
Vous a promis au ciel saturité,
beati qui esuriunt et sitiunt. Tousjours avez desiré l'entretien
De moy, Justice, et hors l'obscurité
Mathei 5. De guerre, France est en securité.
beati pacifici quoniam. Pource que vous estez Roy pacifique,
Promis vous est, par loy evangelicque,
Que vous serez appellé filz de Dieu;
Justicia et Pax osculate sunt. ps. 84. Parfaict en France est l'escript propheticque,
Justice et Paix se baisent au dict lieu.

II.

Interpretation de ce present embleme.[1]

Avecques paix le Roy mantient
Justice, et es deux la main tient;
La prophetie davidique
Est accomplie, ou david dict que

[1] This poem refers to the miniature on the following page, in which Francis I is seen joining the hands of two female figures which represent Justice and Peace. The three are standing within a columned portico which has for a back-

Justice et Paix ont fait accordz
Justicia et Pax osculate sunt. ps. 84. En baisant, mieulx que corps a corps ;
Justice, Iniquité corrompt,
Et Paix a Guerre le col rompt.

III.—Costentin, du Roy serf loyal,
Ce Champ Royal du champ royal.[1]
(2, verso) De France presente a François,
Monarcque illustre des François.

Le maistre ouvrier, qui paradis terrestre
Fist et planta en fruictz delicieux,
Elent en France un tresbeau lieu champestre,
Commode, assez fertile et spacieux,
Pour y dresser un champ solacieux ;
Ce qui fut faict et, par un don celeste,
Ce noble champ, divin, riche et honneste,
Fut ordonné a roys de grand renom,
Par lesquelz Dieu vouloit que supplanté
Fust maint payen ; le champ porte ce nom,
Le champ royal, en troys liz d'or planté.

Couleur d'azur au champ donna ce maistre,
Couleur semblable au saphir et aulx cieulx,
Troys fleurs de liz sur le champ voulut mettre,
Fleurs de liz d'or, metal tresprecieux,
Qui sont en champ comme astres specieux
Sont en hault ciel ; ce noble champ ateste,
Ainsi qu'on peult congnoistre par mainct texte
(D'hystoriens), combien la nation
Des roys est noble, ausquelz fut presenté,
Divinement et par donation,
Le champ royal, en troys liz d'or planté.

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ground the royal dais, with a light blue canopy, marked with fleurs-de-lis. Justice holds the sword and scales in her left hand, while Peace is bearing the olive branch. The two are about to kiss. Justice is trampling under foot a woman with flowing yellow hair and of evil appearance (Iniquité). Peace is likewise treading upon a man in armor who has a broken sword in his hand (Guerre). Near this man is lying a diminutive cannon.

[1] This so-called "Champ Royal" is the ordinary type of the "chant royal" of the sixteenth century.

Ce maistre ouvrier les troys fleurs de liz estre
D'or a voulu, du soleil lumineux
Ont la couleur, qui nous donne a congnoistre
Le Roy de France, en oeuvre fructueux,
Estre des roys le soleil vertueux
Dont la clarté deffend qu'obscure secte
Du faulx Luther son royaulme n'infecte ;
Par sa splendeür et illustration,
Tresamplement, a la foy augmenté,
De ses vertus nous faict ostension
Le champ Royal, en troys liz d'or planté.

Le liz est droict, non tendant a la dextre
Plus qu'a senestre, et en espinuz lieux
Hault elevé, souvent on le voit croistre,
Plus qu'aultres fleurs en beaulté gratieux,
Contre venin, fort et substantieux,
Cela figure haulteur, justice, droicte,
Toutes vertus, en la lignee extraicte
D'Hector, Troyen, et son filz, Francion ;[1]
Mieulx qu'aultres roys de la chrestienté,
Les Françoys ont en leur possession
Le champ Royal, en troys liz d'or planté.

On ne sçavroit dire en prose ne metre
Les dignitéz, graces, droictz copieux.
Que Dieu monstroit aux roys françoys promettre,
Quand a Clovis, par faict miraculeux,
Envoya dons, divins et merveilleux,
Signifiant que le Françoys excede
Tout aultre roy, il n'a qui le precede,
Plus qu'empereur a de perfection,
Par son toucher est veu donner santé,
De luy nous est vray attestation
Le champ Royal, en troys liz d'or planté.

(4, recto) Envoy,

Prince Françoys, d'or la proprieté,
D'azur, du ciel, propre vous a esté

[1] See "La Franciade," the unfinished poem of Ronsard. The legend is also related by Frédégaire, Jean Le Maire, Jean Bouchet.

Et tousjours est ; vostre peuple oraison
Faict que soyez de tout mal exempté,
A vous, Roy, seul convient, selon raison,
Le champ royal, en troys liz d'or planté.

IV.—Dizain de l'interpretation des armes de France.

Des fleurs de liz, aux roys françoys donnéz,
Le hault floron du melieu represente
La foy, les deulx, es costéz ordonnéz,
Sont le clergé et noblesse, excellente,
Qu'ont[1] iceulx roys pour la foy soustenir,
Ce que tousjours ont voulu maintenir ;
Troys fleurs de liz nous donnent a congnoistre
Que verité, mansuetude et justice,
Auroient vigueur en France par la dextre
Du Roy Françoys, dont vraye avons notice.

V.—Dizain sur "sicut lilium inter spinas."[2]

(4, verso)

Comme le liz, entre espines croyssant
Hault elevé, les espines excede,
Ainsi le Roy lilial, aceroyssant
Son bruyt et nom, les aultres roys precede.
L'asperité des espines ne blesse
En rien le liz ; tout ainsi la noblesse
Et vray vouloir du Roy (qui le liz porte),
Blesséz ne sont de poingnantz hereticques,
Maiz contre iceulx la foy garde et supporte
En obviant a leurs fainctes practicques.[3]

VI.—Rondeau sur la louenge et memore des bons.

(6, recto)

Avec louenge, en memore doibt estre
Le juste et droict (ainsy qu'on peult congnoistre
Par maint escript); si juste est mon seigneur,
Mon Prince ou Roy, avec plus grand honneur
De luy, par moy, la louenge doibt croistre.

Memoria justi cum laudibus, prover. X.

[1] The elision in this word as well as elsewhere in the manuscript, is indicated by a small letter "e" raised just above the line.

[2] Canticum Canticorum Solomonis, Cantio I, Cap. II, 2 : "Sicut lilium inter spinas, sic amica mea inter filias."

[3] This dizain is illustrated, on the following page, by a miniature of a lily-plant, with three full-blown lilies and two buds, interwoven symmetrically with a thorn-bush. The plant and bush are framed in a gold-pillared arch, with a light blue background, dotted with gold.

Nomen impiorum putrescat, pruerbiorum, X.

Le juste on doibt louer, le maulvais mettre
La, en oubly ; si juste est donc mon maistre
Plus l'aymer doy, desirant son bon heur,
Avec louenge.

Rectos decet collaudatio, psalmo. XXXII.[1]

Si exhortéz sommes par saincte lettre
Louer le juste, et justice a son estre
Prins en mon Roy, doy je estre dict flateur
Pour le louer? non, puys tout serviteur
Au maistre doibt loyal tousjours paroestre,
Avec louenge.

VII. (A).

(6, verso)

Rex pius in fixo Franciscus cardine pistim
Sustinet : huic vitam suppeditabit Eros.
Magni sub pedibus Regis cognosce Luterum
Stratum ; cui demon praeparat insidias.[2]

(B.)

Le Roy Françoys la foy soustient,
D'oeuvres charité l'entretient,
Le Roy marche sur l'hereticque,
Pour l'avoir, le dyable practique.

(C.)

(7, recto)

Le Roy.

Au Luther le parler deffens
Et la foy crestienne defens.

Charité.

Je tiens le coeur du grand Françoys
Avec les coeurs des bons Françoys.

Foy.

De mon estat je devaloys
Sans le bon Françoys de Valoys.

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[1] Psalms XXXII, 1, "Exultate, justi, in Domino ; rectos decet collaudatio."

[2] This quatrain refers to a half-page miniature of Francis I, scepter in hand, trampling under foot a writhing figure which represents Luther. To the right and left of the king are two female figures representing Faith and Charity. Charity is holding out a platter on which is seen one large red heart and three smaller ones ; she is pointing with her finger at the large heart. A small devil is crouching at one side of the group, and is stretching out towards Luther an iron rod with two hooks at the end. This miniature occupies the upper half of folio 6, verso.

Le Hereticque.

Maintz me croiroient vivantz soubz France,
Mais leur Roy me tient en souffrance.

Le Dyable.

Le Roy soubs le pié ma part tient,
C'est ung Luther qui m'appartient.

VIII.—Dizain de foy, multipliee en ung seul homme plus qu'en tous aultres.

(7, verso)

Durant ce regne, en France on peult congnoistre
Foy de chrestien, foy de prince, et foy d'homme,
Foy de vray Roy, foy de trescrestien estre,
En ung suppost, et foy de gentilhomme,
C'est en Françoys, que treschrestien on nomme ;
Les roys françoys tiltre de treschrestien
Ont obtenu pour le constant soustien
Qu'ilz ont donné a la foy Jesuschrist ;
Sans vaciler ont tenu ce maintien
Depuys Clovis, comme on voit par escript.

IX.—Dizain au Roy sur l'abundance de l'or qui present est en France.

Vray or leans en France vous avez,
(Roy treschrestien), excellent et despreuvé,
Les mines d'or sercher vous ne debvez
D'aultres paiz, si bon or on n'y treuve,
Vous mesme avez la vraye mine ouverte
Ou il fut prins, laquelle fut couverte,
Il a long temps, au grand regret du monde ;
Aultre richesse en France avez, l'or regne
En dict payz, aultre bien y habunde,
Liee en or est de France la Royne.

X (a).—Aenigma de lilio.

(8, recto)

Nupserat auspicio divum, et Junone secunda
Flora deeus mundi Zephiro jucunda marito
Conjugibus pax alma fuit, concordia major
Carmine, certatim pugnabat mutuus ardor
Jusque dies. Zephiri tandem de semine Flora
Lactea protulerat foelici lilia foetu.

Creverat hinc praedulcis amor, foelicia saecla
Ridebant, variis vernantes floribus horti
Liligeri, Hesperidum pomaria contemnebant
Ecce autem stridens Aquilo foelicibus annis
Invidit, Floram que petens, quae libera dulci
Oscula praebebat sponso, pernicibus alis
Advolat hostis atrox subito, cupidus que nocendi
Lilia que et florum genitricem flatibus urget
Horrificis, ciet ille minas male percitus ira,
Eumenides que vocat. Sed enim constantia Divae
Hac rabiem perpessa tenus, nil fracta furore est
Aeolio quanquam occultum spirantia virus
(8, verso) Flamma conciuterent pulchra cum prole parentem
Hinc stimulos odio pudor admovet acrius inde
Percitus invidia divam conjurat in ipsam
Lilia que insequitur clarissima pignora matri
At furit incassum, nam lilia perpetuum ver
Lactea semper alit blandoque Favonius ore
Aeternum aspirans florentes educat hortos.

(B).—L'Enigme, cy devant escript, translaté de latin en françoys par le dict du Mont, aultrement, Costentin.

Flora la belle, (aspirans les haultz dieux,
Juno present), avec le graeieux
Et doulx Zephire, honnestement ornee,
Conjoincte fut ; O l'heureuse journee !
Plusgrande paix que l'on ne pourrot dire
Fut entre eulx deux ; doulce amitié, sans ire,
Tousjours croissoit ; Flora, moult amoureuse,
Beaulx liz produict de la semence heureuse
Du doulx Zephyre, et a ceste raison
Creut leur amour ; lors heureuse saison
(9, recto) S'esjouyssoit, les jardins tous couvertz
De belles fleurs et de beaulx liz ouvertz,
Remplis d'oudeur, et de puanteur vides ;
Trop excedoient des riches Hesperides
Les beaulx jardins. A ceste doulce vie
Et temps heureux Aquilo porte envye,
Serchant Flora, qui franchement s'aisoit
En son espoux et souvent le baisoit,

C'est enuyeux de nuyre avant vouloir ;
Vers eulx on voyt horriblement voller
Par soufflementz, poulséz de grand aspresse ;
Les liz, avec Flora leur mere, presse
En menassant ; pour plus les esbausser
A convoqué les Furies d'enfer.
Mais de Flora la constance et courage
Virilement a soustenu la rage
De l'ennemy, sans quelque estonnement
De sa fureur : combien qu'occultement
Cest Aquilo, portant venin nuysible,
Moult s'efforçast, par soufflement horrible,
Aneantir la mere et les enffans,
(9, verso) C'estoit Flora et les liz triumphans ;
Pour ceste cause augmentee est la hainne,
Et l'ennemy, que triste envye mainne,
Contre Flora gratieuse, conjure,
Serchant les liz pour leur porter injure ;
Maiz il perd temps, car printemps pardurable
Contient les liz en beaulté admirable,
Le doulx Zephire, aspirant doulcement,
Aux beaulx jardins donne nourrissement.

(10, recto)

CENT DISTICQUES[1] DE FAUST ANDRELIN, POETE DU ROY ET DE LA ROYNE,[2] TRADUICTZ EN DISTIQUES FRANÇOYS ; AVECQUES UNG OU PLUSIEURS APPENDICES, EXTRAICTZ SUR UNG CHASCUN DISTICQUE, PAR MAISTRE ELOY DU MONT, DICT COSTENTIN.[3]

XI.—AELIGII MONTANI CONSTANTINATIS AD FRANCIAM SUO FRANCISCO FOELICISSIMAM HEXASTICHON.

Foelix Francorum Franciscum Francia regem
Tu colis, en vobis nomina conveniunt
Moribus ingenuis Francisci Francia mores
Conformes teneas ; mutuus insit amor
Franci Francisco felices pace fruuntur
Franciscum Franci suspiciunt et amant.

[1] See footnote, page 90.

[2] Faust Andrelin was poet laureate to Louis XII and Anne de Bretagne.

[3] We have the testimony of a contemporary of Faust Andrelin, Beatus Rhenanus, as to the high esteem in which the productions of the poet were held. This testimony is found in the preface to the following edition of Andrelin's works: P. Fausti Andrelini, Foroliviensis Poetae atque Oratoris clarissimi Epistolae proverbiales, et morales longe lepidissimae, nec minus sententiosae. In Sylva ducis Brabantiae, anno incarnationis verbi. M.D. XXXI. Mense Aprili. Gerardus Hatart typis has epistolas emittebat.

The preface to this collection is as follows: Beatus Rhenanus, Hieronymo. Gebuilero Selestati bonas literas profitenti S.—Morales P. Fausti epistolae, mi Hieronyme iccirco ad Germanicae juventutis usum, impressioni mandandas duxi, quod viderem eas minime protritam, trivialemque in se continere eruditionem. Nam habent eximiam in primis verborum elegantiam, nec minorem sententiarum (quibus affatim scatent) venustatem. Inveniet hic ingenuus adolescens, non pauca ad bene, beateque vivendum hortamenta. Discet hic amorem mulierum esse fugiendum, et voluptatum fugam, ad sanctiorum vitam quem maxime conducere, ut Graecanico quodem versiculo praecipitur:—Γαστρὸς μὲν πρώτιστά καὶ ὕπνου καὶ φιλότατος, quem hunc in modum Hermolaus Barbarus paraphrasi expressit,—Venter pluma, Venus, laudem fugienda sequenti. Discet praeterea tempus (cujus sumptu nihil praeciosius est) per inertiam non esse transmittendam. Ocium innumerorum malorum feminarium, impensissime evitandum, et id genus plurima, quae omnia Foroliviensis Faustus in his epistolis proverbialibus ac protrepticis, cum lepide, tum gravitem complexus est, qui et si in nonnullis opusculis genuino poetarum more lasciviusculus sit, hic tamen integrum ac modestum oratorem agit. Caeterum norit candidus lector adagia: τὰς παροιμίας (ut Graecia dicunt), quadranter condimentorum rationem subire. His nempe immoderatius in concinnandis eduliis, popinatores utantur, gustu, aut grata incundaque reddent. Illis simili pacto (si modus absit) non tam splendorem, ac ornatum quam obscuritatem sermoni tuo afferes. Mediocritas vero omnia saluat, ubique optima, ut inquit Aristoteles, summus (Pliniano Eulogio) in omni scientia vir. Bene vale, Selestadi pridie Calendas Septembres. Anno, MDVIII.

XII.—In Franciscum monarcham Gallorum omnibus numeris virum absolutissimum Guilielmi Guernonii dodecastichon.

(10, verso)

Classis it ad portus diras spretura procellas
Regis ad invidiam qui timet, auspicia
Nil Mecenatem nam secula nostra requirunt,
Rex niveis illum preterit altus equis.
Quem non obtundant toties monumenta dicata
Humanum summe quid superare queat
Adde, quod est author foeture temporis hujus,
Galle, es quo Hebreus, Grecus et Ausonius
Quum peregrina fovet, parmi ipsa domestica pendit
Abnuit Eligius facta pericla citans
Primas quapropter Franciscus primus habeto,
Hunc unum observet candida posteritas.

XIII.—In eundem ejusdem tetrastichon.

Si sophos est princeps, sophiam vel pectora docta
Diligit, est illi patria fausta sopho
Ter foelix igitur vocitetur Gallia jure
Franciscus sophos est, ac amat ipse sophos.

XIV.—In eundem Gado Fredo vallensis carmen Aelegiacum Cujus littere capitaliores nomen faustissimum ostendunt.

(11, recto)

Funditus evertit summo de vertice Troiam
Rex Danaus, sato Teucria capta fuit
Abstulit (heu miserum) Troiae vestigia Grecus
Nobilis, Ixe penitus mansit adusta focis.
Capta licet fuerint assurgunt moenia Troiae.
Illustrem Francum diruta Troia tulit.
Sic superi Teucris pensant incendia tanta,
Concipit huic Phrigium Martia Troia virum.
Ut nova progenies surgit monimenta decoris
Surgunt, et Gallis aurea secla vigent.
Vivit Priamides nunc regia Pergama restant,
Amplaque Dardanie nomina, Galle, tenes.
Lucida prefulgens Franciscus nomina Franci
Exhibit, hic primus stemmata clara refert.
Nunc quis Franciscum Troiano a sanguine ductum
Summum non referat? quis nisi mentis Mops? (sic)[1]
Ista igitur letus perpendas carmina que nunc
Seminat Eligii Gallica musa tui.

[1] The word "Mops" is probably an abbreviated form of the name "Mopsus," and refers to the soothsayer Mopsus.

(11, verso)

XV.—Au treschrestien Roy des Françoys,
Premier roy de ce nom Françoys,
Costentin, vostre humble vallet,
Prest vous servir, s'il le valloit

Comme ainsi soit (Prince tresmagnanime),
Roy treschrestien, en majesté sublime,
Qu'ingratitude aulx humains et aulx dieux
Soit ung peché grandement odieux
Et desplaisant, pour sa grant turpitude,
Je ne vouldrois en rien d'ingratitude
Estre notté, mais je n'ay la puissance
Que, par effect, face recongnoissance
Aulx biensfaicteurs, entre lesqueilz avez
Le premier lieu (Sire), car vous sçavez
Qu'a Vasteville il me fut ung present
Faict de par vous, lequel sera present
Tant que vivray, en fons de ma memoire.
Je n'avoies pas (Sire), non ay je encore,
Mery qu'a moy vous voulissez parler ;
Tant soeullement, le liberal vouloir
(12, recto) Estant en vous m'a faict ce benefice,
Estre n'en peult la cause mon service,
De rien servir ne vous peult mon sçavoir,
Mais, neantmoins, je doy monstrer avoir
Ung bon vouloir, soit par parole ou lectre ;
Quand aultrement ne le puis recongnoistre
Ung bon vouloir, qu'on veult mectre en effect,
Ille convient reputer pour le faict.
Depuis le temps que fuz a vasteville,
(Roy treschrestien), dedens Caen, vostre ville,
En instruisant mes petitz escoliers,
Cent elegans disticques familiers
Que composa le poete royal
Faust nommé, en vray sens litteral
Traduictz avons, et d'un chacun disticque
Prins et extraict (qui n'est pas grand praticque),
Ung ou plusieurs aultres disticques, dictz
Et appelléz appendices, reduictz
Et appliquéz en quelque sens moral ;
Il ne convient au langaige rural

Avoir regard, mais au sens de la lectre.
(12, verso) Ce qui m'a duict iceulx disticques mectre
En françoys, Sire, est que j'ay congnoissance
Que le françoys a plus grande puissance
Que le latin ;[1] le bon Françoys qui regne,
Nous a causé depuis le vostre regne
Le bon latin ; difficile est, de faict,
Que de maulvais françoys puisse estre faict
Ung bon latin, mais aussi, du contraire,
De bon françoys bon latin fault extraire.
Si ne craingnoies de vous attedier
Je vouldrois bien mon oeuvre dedier
A vostre nom, qu'est ce que je vueil dire,
A vostre nom ? ce mot convient desdire,
L'oeuvre est petit, de rudesse ydropicque,
(Quand de mon faict), et d'elegance ethicque,
Indigne d'estre offert au moindre prince,
Voire seigneur qui soit en la province ;
Et j'entreprens, par folle oultrecuidance,
Le presenter au monarque de France,
Des roys humains l'excellence et la fleur.
Qui vous vouldroit faire dons en valleur
(13, recto) Equipollens a la vostre noblesse,
Il conviendroit visiter la richesse
Et grandz tresors de celeste cité,
Plaine de joye et de felicité ;
Vostre noblesse en dignité excede
Tous biens que Dieu en terre nous concede,
Tant habundant vous estes en tout bien
Qu'on ne pourroit vous augmenter en rien,
Mais nous voyons qu'en la mer, tant diffuse,
Habundent eauz, encore el ne refuse

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[1] The same idea is expressed by our author in his "Résurrection," fol. 1, recto, line 14—De composer la Resurrection.

De Jesus Christ, en langaige françoys
Non en latin, voyant que le françoys
Trop mieulx aymé est, pour le temps qui court
Que le latin ; ceulx qui hantent la court
Et aultres lieux, ont vraye congnoissance
Combien aymé est le françoys en France.—

Likewise, we find on fol. 2, verso, line 11, the following statement : "Costentin, Trop myeulx aymant françoys que le latin."

Petitz ruisseaulx. En grands biens et sçavoir
Vous habundez, neantmoins recepvoir
Vous pourres bien mon petit opuscule
Et l'imprimer dedens une cellule
De la memore. En l'evangile on treuve
Comme une povre et simple femme veufve
Pour avoir mis dens le gazophilace.[1]
Ung seul quadrin remporta plus de grace
Du createur et fut son don trouvé
Plus aggreable et plus grand approuvé
Qu'aultres plusieurs de plus grande importance ;
(13, verso) Dieu regardoit son coeur et sa puissance.
Oultre, je voy que petitz aymez bien,
Car des petitz comme des grandz le bien
Vous deffendez, voullant que de justice
Ait le petit comme le grand, notice.
Pour cez raisons si l'ouvrier et l'ouvraige
Soient bien petitz, si prendray je couraige
De vous l'offrir ; ne regardez, Seigneur,
Le don du tout mais le coeur du donneur.
En recepvant de moy don si petit,
Enbraserez en moy ung appetit
De composer oeuvre de plus hault stille,
Dis je plushault ? selon qu'il soy distille
Par l'alembic de mon engin debile,
Mais pour le rendre aulcun peu plushabile
J'ploreray l'aide de quelque muse
Pour impetrer de sa science infuse,
C'est de Clio, doulce muse historicque,
Laquelle escript en belle rhetoricque
Des nobles coeurs heroicques effectz,
Comme par roys françoys conduictz et faictz.
(14, recto) De ce qu'ung roy a son vouloir estime
Tous ses subjectz, en voirrez faire estime ;
Princes et roys, les petitz font voler
En hault honneur, et les grandz devaler ;
Quand il leur plaist, des subjectz font autant
Comme ung jecteur d'un jecton en jectant,

[1] Mark 12, 41 : "Et sedens Jesus contra gazophylacium, aspiciebat quomodo turba jactaret aes in gazophylacium," etc.

Car ung jecteur ung jecton faict valoir
Cent mille escus, et puis a son vouloir
Le faict valoir une petite maille,
Ce que ne vault l'oeuvre que je vous baille.
Ce nonobstant tant petit qu'il puisse estre,
S'il est loué par le grand prince et maistre,
Le Roy Françoys, grand estimé sera
De toutes gens, et son bruit haulsera,
Ce neantmoins en ce cas ne calenge,
(Roy treschrestien), du monde la louenge,
Mais me suffist que puisse trouver place
Dedens le champ de vostre bonne grace,
Et que prenez en gréy mon petit oeuvre ;
Suppliant Dieu (O Prince), qu'il vous oeuvre
Ses beaulx tresors, lesqueilx il a promis
(14, verso) A ceulx qui sont ses bons et vrays amys,
Apprez qu'aures en ce monde veseu
Bien longuement, et le dyable vaineu

Vous trouverez dedens ce petit livre,
(Que de bon coeur humblement je vous livre),
Une elegie avecques aultres carmes,
Non composéz de jacobins ou carmes,
Mais d'escolliers, domesticques amys,
Avecques nous ung chascun d'eulx a mys,
Voire, et veult mectre en tout temps, pleuve ou vente,
Tout son esprit, non pas pour mectre en vente
Mais pour louer en latin le Françoys
Qui de present regne sur les Françoys,
Et ne mourra (aiudant Dieu), avant aage.
Vous trouverez balades davantage
Et champs Royaulx,[1] dizains avec rondeaulx,
Non composéz par poetes rondz d'eauz
Maiz par vostre humble et infime vallet,
Prest vous servir s'il povoit ou valoit.

[1] Although the plural form is used here, we find but one "chant royal" in the collection.

XVI.

(15, recto)

1.—*Certum Fausti promissum.*[1]

En promissa patent grati monumenta poete,
Certum est Faustino quod semel ore fluit.
La certaine promesse de Fauste.
Voicy les vers du poete acceptable
Par luy promis, car Fauste est veritable.

Appendix.

Bien recongnoist, qui pour don transitoire
Rend aultre don d'eternelle memoire.

2.—*Ad librum ne invidiam extimescat.*

Jam liber invidie secure latrantis abito,
Baubantem est timidi pertimuisse canem.
Au livre qu'il n'ayt crainte d'envye.
Livre va t'en sans craindre envye en rien,
Trop est craintif, qui craint l'abay d'un chien.

Appendix.

Moins mordantz sont les chiens qui tant font bruit,
Triste enuyeux beaucoup parle et peu nuyst.

(composuit) 3.—*Quod disticha casta morata que composuerit.*

Disticha composui matura digna senecta
Nam decet annosum pagina casta senem.
(15, verso) Qu'il a composé disticques, chastes et moraulx.
Mes carmes sont aulx anciens lecture,
A vieilles gens convient chaste escripture.

Appendix.

Paresseux jeune et vieil luxurieux,
Pource superbe, a tous sont odieux.

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[1] I have collated the Latin distichs, as reproduced by Eloy du Mont, with an edition printed in Lyons, in 1539. The important variants found in the edition of Lyons I have put in marginal references. Small differences, such as punctuation and the common use of "ae" and "oe" for "e" in Latin words, etc., I have not indicated. The following is the title of the edition of Lyons:—Disticha Publii Fausti Andrelini Foroliviensis poetae laureati, cum Joannis Mauri Constantiani enarrationibus. Que ab Joanne Raenerio optima fide, parique diligentia recognita sunt omnia. Theobaldus Paganus excudebat, Lugduni. 1539.

(Disticha) 4.—*Dicta salibus respersa.*

Disticha sepe leges, salibus suffusa jocisque
Dict trahunt dulces ad graviora joci.

Distiches meslés de motz joyeux.

Souvent liras vers plains d'urbanité,
De motz joyeulx on vient a gravité.

Appendix.

Grave oraison, ung peu entrelardee
De motz joyeulx, n'en est moins commandee.

5.—*Ad praestantem virum Joannem Ruseum, generalem quaestorum meritissimum.*[1]

Quam fausta dedit missum primordia nummus
Faustior incepta sit quoque finis ope.

Au general Rusé.

(16, recto) L'argent receu, bien commencer m'a faict,
La fin produise encor meilleur effaict.

Appendix.

Ung bon loyer, en livrant, proposer,
Rend les facteurs plus promptz a composer.

6.—*Principium.*

Principium ex alto nascens ardore probatur
Justa sed in solo fine corona datur.

Le commencement.

Moult approuvé est bon commencement,
Mais le loyer est a l'achevement.

Appendix.

Qui bien commence, et qui bien ne parfaict,
On dict qu'a rien n'est a compter son faict.

7.—*Ad disticha.*

Crescite cum largo mea disticha crescite censu,
Deposcunt tute fertile carmen opes.

Aulx distiches.

Crescez mes vers, avec argent utile,
Ung argent seur requiert carme fertile.

Vel.

(16, verso) Quand a l'ouvrier on augmente les gaiges,
C'est la raison qu'il augmente d'ouvraiges.

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[1] See page 94 of the introduction.

8.—*Nulla dies sine linea.*

Nulla dies abeat quin linea ducta supersit
Non decet ignavum preteriisse diem.
Nulle journee sans traict.
Homme ne doit passer ung jour entier
Sans quelque traict faire de son mestier.
Appendix.
Qui veult parfaict estre en quelque artifice
Souvent s'exerce a en faire l'office.

9.—*Ad lectorem.*

Quid me tam miris sublimen laudibus effers
Divinum ingenium plena crumena facit.
Au lecteur.
Pourquoy prens tu de tant me louer painne,
L'engin divin vient de la bource plainne.
Appendix.
Povre poete et nourry d'eau sans vin,
D'engin languit en carme non divin.

10.—*Haud bene cantatur exhausta crumena.*

(17, recto) Legitimus tacto concentus manat ab aere
Non bene cum vacua est ulla crumena sonat.
On chante mal, la bourse vuyde.
L'argent touché, son legitime donne,
Maulvaisement bourse vuyde resonne.
Appendix.
L'argent touché rend doulx son a merveilles,
La bourse vuide, aigre son aulx oreilles,
Vel.
La bourse vuyde ung son rend pytoyable,
Povre poete, ung carme miserable.

11.—*Cecus cantat ob habitam stipem.*

Ipse habita sacram cecus stipe cantat ad aedem
Mutus abit nudam cum trahit ille manum.
L'aveugle chante quand on luy donne.
Apprez argent receu l'aveugle sonne,
Mais il s'en va muet, s'on ne luy donne.
Appendix.
Bien premié, poete bien compose,
Maiz sans loyer sa plume soy repose.

12.—*Pecunia rerum regina.*

(17, verso) (Pecunia) (Jove)

Unica cunctarum regina pecunia rerum
Precipuum magno pro jove numen habet.

Pecune, royne des choses.

De toute chose est pecune la royne,
Au lieu de Dieu en ce monde a le regne.

Appendix.

Pour la pecune on faict et mal et bien,
Mais quand au mal pour dieu on ne faict rien.

13.—*Aurum sole splendidius.*

Clara quidem profert phebeus lumina fulgor
Purius est aurum splendidiusque micat.

L'or plus cler que le soleil.

Le clair soleil grande clarté produict,
Plus pur est l'or et plus clairement luyt.

Appendix.

Argent, procez rend plus clair a mynuict
Que sans argent quand le soleil reluyst.

14.—*Pauper.*

Durius abjecto nihil est quod paupere vivat
Indignus est pauper nil nisi triste malum.

Le povre.

(18, recto)

Rien n'est plus dur qu'estre povre indigent,
Ung triste mal, laissé de toute gent.

Appendix.

S'ung foul est riche, il est sage estimé,
Se sage est povre, il sera foul nommé.

(Pauperi) (nihil)

15.—*Diviti omnia pauperi, aut parum aut nichil.*

Quilibet equoreas semper fluit amnis in undas
Pauperiora culex tecta rotundus adit.

Au riche tout, au povre peu ou rien.

Dedens la mer tous fleuves y arrivent,
Chez povres gens, petitz bibetz y vivent.

Appendix.

En la maison du riche on porte tout,
Du povre rien, ce qu'il a on luy tould.

Vel.

Combien profitte a ung fol grand richesse.
Quand par icelle avoir ne peult sagesse.

16.—*Assentator.*

(gnatoni) Qui blando patulas parasito[1] commodat aures,
Insanum ex stulto pectore pectus habet.

(18, verso) L'assentateur.

Si les flateurs escouter te consens
De levité, deviendras hors du sens.

Appendix.

L'assentateur est veu, doulx et benin.
Donc la doulceur tourne en amer venin.

17.—*Debitor.*

Semper et infelix alieni debitor aeris
Duraque servili vincula mente gerit.

Debteur.

Malheureux est du bien d'aultruy debteur
Et n'est pas sien, mais il est serviteur.

Appendix.

Soy obliger est chose voluntaire,
Mais le contract tenir est necessaire.

18.—*Amor.*

Non amor antiquo fuerat sed amaror ab aevo
Dicendus, quum sit semper amarus amor,

Amour.

En lieu d'aymer convenoit dire amer,
Car d'amertume va plus qu'en la mer.

Appendix.

(19, recto) Amour disoient estre ung dieu, mais ung dyable,
Dieu est tout bon, amour faulx et dampnable.

19.—*Idem.*

Cura placens, predulce malum, tristisque voluptas
Heu vesana furens pectora cecat amor.

Icelluy amour.

Folle amour est volupté, triste et brefve,
Et ung doulx mal qui du sens les yeulx creve.

Appendix.

D'ung peu de miel amour mondainne apispe,
Mais donne apprez de fiel plus d'une pipe.

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[1] Maurus employs the word "gnatoni," taken in its general sense;—Terence, Eunuchus, 2, 2, 33.

Vel.

De volupté amour donne une estrainne,
Qui de douleurs trop longue queue trainne.

20.—*Non amans sed amens.*

Si sapis amentem dicas non lector amantem,
Nam nihil insanus mentis amator habet.

Non amans mais amens.

Amens c'est foul, dire on doit, non amans,
Car rien prudent n'est en ces foulz amans.

Appendix.

(19, verso) Le fol amant en peril se va metre
Que bien il voit, mais de soy n'est pas maistre.

21.—*Leno.*

Communis stulte pestis damnosa juvente,
Surripit incantas leno dolosus opes.

Le maequereau.

Le maequereau est peste de jeunesse,
D'imprudens foulz consomme la richesse.

Appendix.

La fille on voit par la mere, et la femme
Par le mary, vendus, c'est cas infame.

Vel.

On doibveroit, plustot que larrons, pendre
Houilliers qu'on voit la chair humaine vendre.

22.—*Scortum.*

Non scortum est aliud nisi blanda et subdola syren
Que trahit humanum sub vada ceca genus.

La paillarde.

Une paillarde, ainsi qu'une serainne,
Pour submerger, attraict jeunesse humainne.

Appendix.

(20, recto) Passer convient avec sourdes oreilles
Paillardes, qui de parler font merveilles.

23.—*Idem.*

Ad vivam scortum suggens ut hyrudo medullam
(Paphiam exhaurit) In paphiam exharuit pectora prona deam.

Icelle.

Une paillarde, ainsi qu'ung sansue,
Tire le sang de jeunesse decene.

Appendix.

En faict d'amours on ayme qui apporte,
S'il n'a plus rien on luy clorra la porte.

24.—*Foemina.*

Cuncta sub astrigero regnantia crimina celo,
Nutrit in eternos femina nata dolos.

La femme.

La femme nee, a fraude et a traison,
En ce monde est de tous pechéz poyson.

Apologie.

La femme aussi (c'est la Vierge benigne),
En ce monde est de tous biens origine.

Vel.

(20, verso) La femme nee a, bien sage et docile,
En ce monde est de tous biens domicile.

25.—*Caput foemineum.*

Non si femineum crebro caput igne refundas,
Ingenii mutes prima metalla sui.

La teste de femme.

De femme soit la teste refundue,
El ne sera pas plus molle rendue.

Apologie.

Teste de femme a bonté si parfaicte
Que pour refondre el n'est meilleure faicte.

26.—*Coitus.*

Turpis et est morbi species horrenda caduci,
(Venus) Cum jacet exanimis post sua furta venus.

Acte charnel.

Acte charnel de mal caducque espece,
Appres le faict l'homme rend en tristesse.

Appendix.

L'abbus est sot de volupté mondainne,
Qui l'homme rend en tristesse soudainne.

27.—*Vinum.*

(21, recto) Immodicus ledit seu dira cicuta lieus,[1]
Non facit ad longam crapula multa diem.

Le vin.

[1] The reading "lyaeus," given by Maurus, is preferable here and is to be taken in the sense of "wine."

Vin superflu comme cigue blesse,
Moult nuyst exces a venir en viellesse.

Appendix.

Exces de vin de l'homme corrompt l'aage,
Truble le sens, foul en devient le saige.

28.—*Ad bibacem.*

Aebria ne titubent dubio vestigia gressu,
Temperet appositum limpha refusa merum.

A l'ivroingne.

Yvroingne, affin que ne tumbes au vent,
Ton vin convient d'eau moderer souvent.

Appendix.

Exces de vin nostre esprit faict changer,
S'il est trublé le corps est en danger.

29.—*Ad eundem.*

Non imos aepota pedes sed bacchica summum
(Parcius) Vis caput invadit parcius ergo bibe.

A icelluy yvroingne.

(21, verso) Le vin aux piedz ne va mais au cerveau,
Boy donc petit ou le modere d'eau.

Appendix.

Le gouvernail nous est sobrieté,
De gouvernail n'eut onc ebrieté.

30.—*De venere et baccho.*

Semper juncta venit bibulo cytherea lyeo,
Res est inflamans luxuriosa merum.

De paillardise et yvrongnise.

Avec le vin paillardise repose,
Car le vin est luxurieuse chose.

Appendix.

Luxure et vin rend l'homme en tel estat
Que le plus saige en devient apostat.

31.—*Gula.*

(Croesi) Sint ignota licét magni patrimonia croesi,
Immensae absumunt alta barathra gulae.

D'un glouton.

D'un ort glouton le ventre insatiable
Devoreroit ung bien inestimable.

Appendix.

(22, recto) Gulosité, excessive et infame,
Consomme biens et destruict corps et ame.
Vel.
Estre subject a gourmandise vile
Et volupté est chose trop servile.
Vel.
Superfluité, de grand povreté mere,
Est en la fin aulx gourmans tresamere.

32.—*Otium.*

(forti celsas) Corrumpunt celsas forti cum pectore mentes
Otia plumoso desidiosa thoro.
Oesivetté.
Oesiveté et long dormir en liet
Le corps puissant et coeur noble amollist.
Appendix.
Oesiveté nous engendre peché,
Les membres las et l'esprit empesché.

33.—*Somnus.*

Quam vigil ignavo demit solertia somno,
Additur hec vite longior hora tue.
Dormir.
(22, verso) L'heure et le temps, de long dormir ostéz,
Seront pluslongz a la vie adjouxtéz.
Appendix.
Par trop dormir chet l'homme en indigence,
Biens on acquiert par bonne diligence.

34.—*Fama.*

(cleonaeo) Alta cleoneo querenda est fama labore,
Non venit ex molli vivida fama thoro.
Renommee.
Par grand labeur fault acquerir bon nom,
De long dormir ne vient pas bon renom.
Appendix.
Sans batailler on n'a pas la victoire,
Et sans labeur n'aurons parfaicte gloire.
Vel.
Qui veult avoir bon nom et bonne grace,
Parle tresbien et chose utile face.

35.—*Avarus.*

(se Tantalus) Semper eget sitiens mediis ceu tantalus undis
Inter anhelatas pauper avarus opes.

L'avaricieux.

(23, recto) Tantalus est dedens l'eau, sitibunde,
L'avare est povre en bien qui luy habunde.

Appendix.

Si content est povre en biens, il est riche,
Le riche en biens est povre s'il est siche.

36.—*Invidus.*

Invida perpetuis urit praecordia flammis
Incedens fausto sors aliena pede.

L'envieux.

Le bien d'aultruy, prosperement croissant,
Brule le coeur d'envyeux languissant.

Appendix.

Detraction vient du peché d'envie,
Qui la cause est que mainct n'est plus en vie.

37.—*Fortuna.*

Vitrea dum splendet vultu fortuna sereno,
Protinus in vili fracta recumbit humo.

Fortune.

Fortune, apprez belle face exibee,
Incontinent chet aplat succumbee.

Appendix.

(23, verso) Souvent fortune extolle l'homme en hault,
C'est pour apprez luy donner plus grand sault.

(Forunae) 38.—*Amici fortune.*

Agmina que nitido credis fidissima caelo.
Nube sub obscura terga fugata dabunt.

Amys de fortune.

Amys assez en ta felicité
Qui te fuyront en temps d'adversité.

Vel.

Si tu es riche auras assez d'amis;
Si tu es povre ilz seront ennemys.

Appendix.

Dedens le feu on faict de l'or espreuve,
Au grand besoing son amy on espreuve.

39.—*Servandus modus in utraque fortuna.*

(fractumve) Ne dextra elatum videat fractumque sinistra
Adsit fortune certus utrique modus.

Mesure est a avoir en bonne et maulvaise fortune.

Sans orgueil soys en fortune prospere,
En malle aussi pas ne te desespere,

Appendix.

(24, recto) C'est plus que tout, que tenir le moyen,
Estre constant et en mal et en bien.

40.—*Adversa fortuna tolleranda.*

(Ulisseo) Perfer ulisseo sortem de more sinistram,
Haec bene duranti sub pede victa jacet.

Fortune adverse porter convient.

Comme Ulisses pren la fortune triste,
Vaincre la peult celuy qui bien persiste.

Appendix.

Prenons le temps ainsi comme il nous vient,
En maulvais temps bon coeur avoir convient.

Vel.

Pourvoir convient a fortune future,
Il n'aura rien lequel ne s'adventure.

Vel.

Effeminéz, de coeur lache et remys,
S'il vient fortune ilz sont tost au bas mys.

41.—*Adversis succumbens.*

Casibus adversis fracta qui mente recumbit,
Fortuna ignorat dexteriore frui.

Qui succumbe en adversitéz.

(24, verso) L'impatient de mal et d'infortune
User ne peult de la bonne fortune.

Appendix.

Qui veult doulceur congnoistre, il fault qu'il hume
Et qu'il avalle ung petit d'amertume.

(Hypocrita) 42.— *Ypocrita.*

Ne pura explicite credas sub ymagine fronti,
Raptorem occultat pellis ovina lupum.

L'ypocrite.

Trop ne te fie aux faces tant affables,
Brebis a voir, dessoubz loupz ravissables.

Appendix.

N'ayons du tout aux vestemens credit,
L'habit ne faict le moyne, ainsi qu'on dict.

43.—*Idem.*

Exteriora gerit qui simplicis ora columbae,
Interiora vafrae pectora vulpis habet,

Icelluy.

Tel est columbe en face exteriore,
Et faulx regnard en coeur interiore.

Appendix.

(25, recto) Dessoubz le miel est caché le venin,
Ung coeur cruel soub visaige benin.

44.—*Superbia.*

Turgida ventosos imitata superbia folles
Pascitur aerio corpus inane noto

Orgueil.

Comment souffletz de leger vent grossissent,
De vent de gloire orguilleux soy nourrissent.

Appendix.

Hault edifice est fort subject au vent,
Des orgueilleux l'orgueil tumbe souvent.

Vel.

L'umbre est plus court quand le soleil hault court,
Par hault orgueil est faict l'honneur plus court.

45.— *Venetus.*

Plumosa inspiceres nudatum corpora corvum,
(Veneto) Reddita si veneto preda latrone foret.

Le venitien.

Venitiens aussi nudz que le ver
Voyras, s'ilz font de rendre leur debvoir.

Appendix.

(25, verso) Mainct faict le pan se vantant de son bien,
S'il estoit quicte il auroit moins que rien.

(Caesarem Borgiam)

46.—*Ad caesarem borgiam.*[1]

Aut nihil, aut caesar vexillo pingis inani
(Caesare) Pro magno fies caesare stulte nihil.

A Cesar Bourgias.

Estre Cesar ou rien te paingnois bien,
Car pour Cesar tu es devenu rien.

Appendix.

Qui par orgueil plus hault que ne doibt monte,
Il doibt descendre en confusible honte.

47.—*Juventa.*

Accensa exardens flammata libidine pectus,
Labitur in cunctem prona juventa nephas.

Jeunesse.

Jeunesse ardante, a volupté incline,
Facillement en tous pechéz decline.

Appendix.

Cheval trop aspre on arreste o la bride,
Jeunesse ardante en luy baillant bon guyde.

Vel.

(26, recto) A ung dure asne aguillon dur convient,
Par corriger le foul saige devient.

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[1] Maurus, page 65, gives the following note upon this distich: Taxat arrogantiam ac stultitiam Caesaris Borgiae Hispani. Hic Alexandri sexti filius erat nihilo patri dissimilis, sive vitam, sive exitum utriusque; aestimes. Relicto cardinalitio galero uxorem duxit, et dux Valentinensis factus est. Illum Italiam bello tentantem scommatis Itali lancinabant: iste (inquiunt) armis caelum territat: Quod admodum magniloquus, velet alter Thraso, praeterea minacissimus, ac ferocissimus esset. Item iste (inquiunt) arrogantia gigantum laborat, quod scilicet nullis viribus, nullo concilio, sed temerarie stulteque; rem tantam id est, imperium orbis aperte moliretur. Et alius hoc distichon ejusdem sententiae in eundem scripsit:

Aut nihil, aut votis optabas omnia Caesar,
Omnia deficiunt, incipis esse nihil.

Iste igitur magnificus Thraso, haec verba (aut nihil, aut Caesar) in suo vexillo pingi jusserat, quorum sensus est, aut nihil ero scilicet: aut Caesar, id est, orbis debellator, et monarcha. Verum tandem miserime vitam finivet.

Ordo. O. Borgia scilicet "Pingis," id est: pingi facis "in vexillo" id est, in signo militari, "inani" id est, frivolo et veri Caesaris nomen non habenti. "Aut nihil aut Caesar" id est, nihil memoria dignum gerens, aut ero Caesar, id est, rebus gestis clarissimus. et imperator triumphantissimus "stulte" id est, o demens; "fies," id est, eris. "Nihil," id est, homo nullius praetii, ac gloriae; "pro caesare," id est, pro imperatore; "magno," id est claro.

48.—*Senecta.*

(defertt) Prudentem exhausto mentem pro robore defert,
Matura et longa cocta senecta die.

Vieillesse.

En vieilles gens pour force corporelle
Sont bon conseil, sens, raison naturelle.

Appendix.

L'artillerye est rien sans bonne amorse,
Sans bon conseil ne sert beaucoup la force.

Vel.

Force de corps ne conduict, mais sagesse,
Les faictz arduz en quoy reluist vieillesse.

49.—*Ficus gallica ad Jo. Ruseum.*

(Gallia) Fertilis at raras gignit quas gallia ficus
Accipe, nam raros non nisi rara decent.

Figues gallicques a Jehan Ruséy.

Figues reçoy qui peu en France viennent,
A gens de prix precieux dons conviennent.

Appendix.

(26, verso) On ne doit pas extoller en honneur
Du tout le don, mais le coeur du donneur.

50.— *Garrulus.*

Extremum ad malum primo quae obtundit ab ovo
Vitanda est mense garrula pica tuae.

Le garrule.

Homme importun, a parler sans raison.
Ne permectras menger en ta maison.

Appendix.

Langue est a craindre, en bouche d'envieux,
Plus que le glaive en main de furieux.

51.—*Dentes.*

Natura omniparens dentes formavit acutos
Ne vaga sed claustris lingua sit arcta suis.

Les dentz.

Les dentz agus nous a formé nature
Pour contenir la langue en sa closture.

Appendix.

Huys et serreure a la bouche ordonnez,
Long et balance aux parolles donnez.

Vel.

(27, recto) De la parolle ayns que parler suys maistre,
Quand el est hors servant m'en suis faictestre.

Vel.

Ayns que parler ayons le souvenir
Que parler va et ne peult revenir.

52.—*Lingua.*

Quid melius lingua? lingua quid pejus eadem?
Tristis cum dulci toxica melle gerit.

La langue.

Qu'est il plus bon et plus maulvais que langue?
Miel et venin el porte en sa harengue.

Appendix.

Le gouvernail la nef garde ou destruict,
La langue l'homme a bien ou mal instruict.

Vel.

Le gouvernail et la langue conduysent
Navire et homme, ou du tout les destruysent.

53.—*Fides.*

Aurea quam sancto coluerunt secula ritu
Aut nulla aut nostro est tempore rara fides.

La foy.

(27, verso) Des anciens la foy si bien gardee,
Au temps present n'est plus que foy fardee.

Appendix.

Qui pert sa foy a perdre n'a plus rien,
La foy en l'homme est ung excellent bien.

54.—*Homo.*

Quid genus affectas vitam mortale perennem
(brevi) Cum sis momento bulla caduca ( )

L'homme.

Pourquoy tousjours veult vivre au monde l'homme,
C'est ung bouillon qui sur l'eau tost consomme.

Appendix.

En nasquissant commençons a mourir,
Et vers la mort ne cessons de courir.

Vel.

Convient il tant ce povre corps nourrir
Lequel sera demain mis a pourrir.

55.—*Mors.*

Clam venit orta metens aequa mors omnis falce
Hinc habet incertam nescia vita diem.

La mort.

(28, recto) En secret vient la mort tout devorante,
Parquoy la vie est son terme ignorante.

Appendix.

Tous quand au naistre et mourir sont semblables,
En vivre sont soeullement dissemblables.

Vel.

Le serviteur qui ne sçoit quand son maistre
Doibt revenir, tousjours veillant doit estre.

56.—*Mors haud timenda.*

Tensa quid horrescis missuram spicula mortem ?
(est) Non mors, sed passi ( ) meta suprema mali.

Mort non a craindre.

Pourquoy de mort crains tu le gleve extreme ?
Mort n'est pas mort mais de mal fin supreme.

Appendix.

Qui parvenir veult a vie parfaicte,
Passer convient la mort palle et infaicte.

Vel.

Qui soeullement ton corps pourroit occire
Ne crain, mais qui ton ame peult destruire.

57.—*Servus.*

(28, verso) Quis non servili dominus fraudatur ab arte ·
Prodigium servus grande fidelis erit.

Le serviteur.

Qui n'est trompé des servans cautelleux ?
Servant loyal est cas miraculeux.

Appendix.

A tart on treuve amytié, si non faincte,
En cestuyla qui ne sert que par crainte.

58.— *Uxor dignitatis nomen non voluptatis.*

Nomina seposita veneranda libidine gestat
Quam junxit casto copula sancta thoro.

Uxor nom de dignité non point de volupté.

Ce nom de femme est de grand dignité
En mariage, hors toute volupté.

Appendix.

C'est l'ornement de l'homme que la femme,
La concubine au contraire diffame.

Vel.

Par mariage ung enffant en bas aage
Est faict sage et estimé plus saige.

Vel.

(29, recto) Dict paradis mariage peult estre,
Car dieu le fist en paradis terrestre.

Vel.

Priser sa femme, aymer et craindre, reste,
Et estimer, ainsi qu'un don celeste.

59.— *Uxor ob sobolem ducenda.*

Uxor habenda venit, non ut saturata libido
(si) Sed sit in aeternos aucta propago dies.

La femme pour avoir lignié.

Pour volupté marié ne fault estre,
Mais pour lignee et gerre humain acroistre.

Appendix.

Sans volupté de femme fault user,
De mariage on peult bien abuser,

Vel.

Qui maintenir ne soy peult en honneur,
Soy marier fault, en nostre Seigneur.

60.— *Curia.*

Larga quidem magnos promittit curia montes
Irrita sed rapidis verba feruntur aquis.

La court.

(29, verso) Ce sont haultz montz, que promesses de court,
Mais aval l'eau bien tost cela s'en court.

Appendix.

Grand promecteur est souvent grand menteur,
De petit faict on voit ung grand vanteur.

Vel.

Nul escondire au prince est moult louable,
Mais la requeste estre doit raisonnable.

61.—*Eadem curia.*

Quam bene conveniens sortita est curia nomen
A gravibus curis curia dicta venit.

Icelle court.

La court, on dict, en latin curia,
Car en la court grand soing et cure y a.

Appendix.

A voir, en court, maistres et varletz faire,
On ne congnoist lesquelz ont pludaffaire.

62.—*Pax.*

Securus placida mundus sub pace quiescit
(alta) Tranquillum est summi opus alma dei.

La paix.

(30, recto) Soubz paix on vit en repos pacificque,
Tranquille paix vient du hault dieu celicque.

Appendix.

Le petit bien est faict grand par concorde,
Le grand, petit, ou sont guerre et discorde.

63.—*Bellum.*

Persurit, et totum miscet mars impius orbem
(est) (Jove) Heu diro inventa ( ) sub jove tanta lues.

La guerre.

Guerre et descord troublent toute la terre,
Soubz Jupiter trouvee fut la guerre.

Appendix.

Guerre on ne doit en ce monde mouvoir,
Si non pour paix plus grande appres avoir.

64.—*Inclementia bellica.*

Nulla est ardenti miserans clementia bello
Impetuosa pium dextera nescit opus.

Inclemence bellicque.

Fureur bellicque est sans misericorde,
Bras furieux a mercy ne s'accorde.

Appendix.

(30, verso) Contendre a force est aux bestes cruelles,
L'homme en parler doit mener ses querelles.

65.—*Haud esse post victoriam seviendam.*

(triumpho) Bellica quaesito frenanda est ira thriumpho.
Haud sevit domito nobilis hoste manus.

Cruel ne convient estre apres la victoire.

Ne soys cruel, l'ennemy desconfit,
A noble coeur d'avoir vaincu suffist.

Appendix.

Vaincre est assez sans faire cruaulté,
Le noble coeur de vaincre est contente.

Vel.

Le droict garder, l'ennemy prins, conseille,
Si ce n'estoit en rendant la pareille.

Vel.

Par obayr, le lion on modere,
L'homme raison estre en soy considere.

Vel.

Celuy qui prins est en captivité,
Que peult il plus faire d'hostilité.

66.—*Ira.*

(31, recto) Sanguine scintillans ferventi naseitur ira
Quae semper domina mente domanda venit.

Ire.

Du sang fervent embrasee ire vient,
Mais par raison refroyder la convient.

Appendix.

Par ire vient au vys deformité,
Et mect l'esprit hors de tranquillité.

Vel.

Qui ne modere ire par patience,
Il pert raison et si n'a pas science.

67.—*Bombarda.*

Si celsum quateret moles bombardica caelum.
Tota foret capto machina strata jove.

La bombarde.

Si la bombarde au ciel pouvoit toucher,
(Jupiter prins), feroit tout trebucher.

Appendix.

L'artillerie est argument fecunde,
Que bien pres est, par feu, la fin du monde.

Vel.

(31, verso) L'artillerie empesche en bataillant
Que congneu soit lequel est plus vaillant.

(Justitia) 68.—*Justicia.*

(libritaque) Aequa gerit rectam librat quae pondera lancem
(Justitia) Justicia immota firma tenaxque manu,

Justice.

Juste ballance en sa main tient justice,
Donc justement de peser faict l'office.

Appendix.

Ung prince avoir doit l'espee ou la lance
En une main, en l'autre la ballance.

69.—*Prudens.*

Quisquis es o prudens janum[1] sectare bifrontem
(videnda) Sunt ora atque oculis terga videnda tuis.

Le prudent.

Toy qui prudent veulx estre en la maniere
Du bon Janus, voy devant et desriere.

Appendix.

Nostre esprit soit a troys temps dispencé,
Au temps present, preterit, et passé.

Vel.

(32, recto) Il est brutal et de prudence exempt,
Qui seullement regarde au temps present.

Vel.

En tous lieux est le present estimé,
Pour le present on en est myeulx aymé.

70.—*Fortis.*

Instanti veniunt subeunda pericula casu,
(angustis) Rebus in *adversis* fortia corda patent.

Le fort.

[1] The old Italian deity, represented with a face on the front and another on the back of his head.

Contre fortune il convient qu'on resiste,
En faictz ardus, coeur vertueux consiste.
Appendix.
Force et vertu sont bien manifestéz
En ceulx qui sont de fortune infestéz.

71.—*Modestus.*

Servanda in rebus praefixa est meta gerendis,
Non excessa pudens facta modestus amat.
Le modeste.
Mesure on doit garder en tout effect,
L'homme attrempé rien excessif ne faict.
Appendix.
(32, verso) Ne fay rien trop, ta puissance mesure,
Toute vertu pèrt son nom sans mesure.

72.—*Lex.*

Lex sancta humanae ducta est qua regula vite
Demissum aethereo munus ab orbe venit.
La loy.
La saincte loy, qui regist vie humaine,
Est don venant de celeste dommainne.
Appendix.
Ou loy n'est pas, aussi non est justice,
Sans ce, n'avons de bien vivre notice.
Vel.
D'administrer les loix n'est suffisant,
Lequel veult estre aulx loix contredisant.

73.—*Juris decreta.*

Si sublata forent Juris decreta verenda,
Vinceret immanes barbara vita feras.
Les decretz de droict.
Si droictz estoient casséz et abbatus,
Humains vivroient brutaulx et sans vertus.
Appendix.
(33, recto) Craincte des droictz, de mal faire retarde,
Et le pais bien vivant en paix garde.

(voluminum) 74.—*Comburenda in leges volumina massa.*

Emissa in sacras numerosa volumina leges
(Phetontea) Sunt phaetontea tedia digna face.
La masse des volumes sur les loix est bonne a brusler.

Tant sur les loix, commentz accumuléz,
Sont longs ennuys dignes d'estre bruléz.

Appendix.

Texte de droict est trop plus manifeste
Que vieulx commentz faictz sus icelluy texte.

Vel.

Dessus le texte est chose trop confuse,
Que tant commentz qui les espritz abuse.

75.—*Imperitus legum doctor.*

Icturus nullam centeno verbere legem
Non legem es doctor (vane) quid ergo ? dolor.

Le non expert docteur de loix.

Qui d'alleguer une loy n'a pas l'heur,
En loix docteur, il n'est quoy donc ? douleur.

Appendix.

(33, verso) Maint grassement de la science vit,
Qui le dedens du livre onques ne vit.

76.—*Sorbonicus.*

Sorbonica invictus lucta quicunque redisti,
(Herculeas) Tu potes herculeas spernere tutus opes.

Le Sorbonicque.

Qui peult sortir de Serbonne vainqueur
Craindre ne doibt Heurcules belliqueur.

Appendix.

D'icelluy est la victoire louable,
Qui vaincre peult Sathan, monde et le dyable.

Vel.

Quiconque est roy de soy mesmes et maistre,
C'est plus grand cas que roy des aultres estre.

77.—*Sophista.*

Caprinae nugas lanae[1] si poscis inanes
Stentorea exclamans voce sophista dabit.

Le sophiste.

Si disputer veulz de lainne caprine,
Ouyr convient sophisticque doctrine.

[1] Horace, Ep., 1, 18, 15;—"Alter rixatur de lana saepe caprina, propugnat nugis armatus."

Appendix.

(34, recto) Mainct par crier s'esforce d'apparoistre
Estre sçavant quand sçavant ne peult estre.

78.—*Medicus illustris.*

(Apolinea) Clarus apolinea medicus qui fulgeat arte
Extat adoranda ceu deus alter ope.

Medecin illustre.

Bon medecin de sçavoir decoré,
Ainsi que Dieu il doit estre adoré.

Appendix.

De l'ame et corps la santé Dieu nous donne,
Le medecin de nostre corps ordonne.

79.—*Medicus indoctus.*

(ducam) Cum dicam culo merdam egrotantem caeatam,
Non ementito merdicus ore vocor.

Medecin indocte.

Si tirer puis merde du cul de l'homme,
Sans en mentir merdecin on me nomme.

Appendix.

Mainct abuseur entreprent faire bien
Une besoingne ou il ne congnoist rien.

Vel.

(34, verso) Mainct imprudent entreprent faire tout,
Lequel jamais de rien ne vient a bout.

80.—*Philosophus naturalis.*

Foelix cui nota est naturae caussa latentis,
At sua qui noscat pectora rarus adest.

Le philosophe naturel.

Qui bien congnoist les causes heureux est,
Mais rare il est lequel bien se congnoist.

Appendix.

Faulte de sens et de bien se congnoistre,
L'homme couard et superbe faict estre.

81.—*Socrates.*

(Olympo) Morigeram ex alto sophiam qui traxit olimpo,
(Actaeum) Sustulit acteum sorpta cicuta senem.

Socrate.

Par Socrate vint morale science,
Boyre on luy fist cicue en recompense.
Appendix.
Ingratitude envers hommes et dieux
Sur tous pechéz est le plus odieux.

82.—*Astrologus.*

(35, recto) Mirum quum toto noscat stata sidera celo,
(an) Nesciat in patria mecha sit uxor humo.
L'astrologue.
Au ciel congnoist l'astrologue et regarde,
Et ne congnoist si sa femme est paillarde.
Appendix.
Pas n'est certain cestuy la qui devine,
Car deviner n'est science divine.

83.—*Furor poeticus.*

Vatibus aeternis caelo descendit ab alto,
Ad nova divinus tacta canenda furor,
Fureur poeticque.
Fureur divin aulx poetes descend
Pour composer nouveaulx gestes decent.
Appendix.
Nominer l'en peult divins et sainctz poetes,
Ceulx qui de dieu ont esté vrays prophettes.

84.—*Orator.*

(fulmen) Intonat aetherea ceu missum *munem* ab arce,
Concita fulgurei lingua diserta viri.
L'orateur.
(35, verso) De l'orateur la langue est vehemente,
Ainsi qu'en l'air la fouldre qui tourmente.
Appendix.
Ung orateur acomplit mainct affaire
Qu'on ne sçauroit par force d'armes faire.
Vel.
Ung orateur rompt la fureur des princes,
Amys les faict au grand bien des provinces.
Vel.

Doulce parolle, ire et couroux supprime,
Rude parolle, ire et couroux anime.
Vel.
Le doulx parler, dict on, n'escorche langue,
Et beaucoup peult une doulce harengue.

85.—*Poete presentis seculi.*

Delphica non redolens afflantia numina carmen,
Secula sed faetens nostra cacamen habent.
Les poetes du temps present.
Dire ne fault le carme redolent,
Du temps present, mais le carme dolent.
Appendix.
(36, recto) Humains sont linx a voir d'aultruy le faict,
Mais taulpes sont en l'oevre qu'ilz ont faict.
Vel.
Sur tous oyseaulx bien pense le corbeau
Avoir ung chant fort doulx et le corps beau.

86.—*Oratores ejusdem aetatis.*

Creditur orator nostrum quicumque per evum,
Si verum excutias nomen arator erit.
Les orateurs de ce temps.
Celuy qu'on croit en ce temps orateur,
S'on cherche bien son nom est arateur.
Appendix.
Qui bien sçait l'art de bien dire, il congnoist
Quand de parler le temps oportun est.

87.—*Pontifex maximus.*

Praeficitur pastor baculo munitus adunco,
Ut vigili errantes lumine servet oves.
Le tresgrand pontife.
Pasteur avons de houlette muny
Pour son troupeau garder ensemble uny.
Appendix.
(36, verso) Dieu pour pasteur le pape a mis au monde
Pour conserver l'ouaille pure et munde.
Vel.
Le bon pasteur doit corps et ame mectre
En deffendant l'ouaille, donc est maistre.

88.—*Cardinalis.*

Hic habet a fixo deductum cardine nomen,
Debeat ut firmam sustinuisse fidem.
Le cardinal.
De cardo, gout, cardinal peult venir,
Car gout doit estre a la foy soustenir.
Appendix.
Ainsi que l'huys au gond ferme soy tient,
Ung cardinal la foy ferme soustient.

89.—*Ad eundem.*

(purpura) Monstrat sanguineam fundes tua purpurea vitam,
Clavigerum invadunt cum fera bella thronum.
A icelluy.
Aulx cardinaulx le rouge donne entendre
Que jusqu' au sang la foy doibvent deffendre.
Appendix.
(37, recto) Pas n'est crestien qui refuse mourir,
Quand besoing est, pour la foy secourir.
Vel.
Tous roys françoys pour leur ferme soustien
Envers la foy, ont nom de treschrestien.

90.—*Episcopus.*

Caetera quo superet meditanti pectora sensu,
Imposita ex ipsis nomina rebus habet.
L'evesque.
Des siens a soing l'evesque en diligence,
Si du nom suyt la vraye intelligence.
Appendix.
Evesque est nom digne d'homme prudent,
Qui vault autant que superintendent.
Vel.
Pasteurs rendront de leurs brebis le compte,
S'ilz perdent rien le rendront a grand' honte.

91.—*Lis.*

(misero fiet) Ille brevi fiet misero mendicior iro,[1]
Tristia qui litis bella forensis amat.
Proces.

[1] The name of the beggar in the house of Ulysses at Ithaca. Maurus writes this word with a capital letter.

(37, verso) Povre et meschant, plus qu'Irus, deviendra
Qui de procez la guerre entretiendra.
Appendix.
Proces ingrat servez et aymez bien,
Il vous fera perdre tout vostre bien.
Vel.
Proces est lac et gouffre si profund
Que tout le bien qu'on peult avoir y fond.
Vel.
Tant plus aymez faulx et traistre procez,
Et d'autant plus vous fera de l'excez.
Vel.
A faulx procez tant plus on baille et tend,
Tant plus en veult, jamais il n'est content.

92.—*Poeta alienus a lite.*

Litigiosa fugit studiosus jurgia vates,
Non amat insanum musa quieta forum.
Le poete doibt estre aliené de proces.
Triste proces soingneux poete fuyt,
Muse transquille hayt de plaider le bruit.
(38, recto) Appendix.
Qui veult latin ou françoys composer,
Toute aultre affaire il convien deposer.

93.—*Mercator perfidus.*

Perjurata suo postponit numina lucro,
(Stygiis) Mercator stigiis non nisi dignus aquis.
Le marchant desloyal.
Marchant prepose au hault Dieu qu'il blaspheme,
Son gaing mondain digne d'enfer extreme.
Appendix.
Quel proffict estre a l'homme ou a la femme
De gaingner tout le monde et perdre l'ame.

94.—*Rex aculeo carens.*

Quid metuis princeps diro caret inclitus oestro,
Non facit ad magnos ultio seva duces.
Le roy est sans aguillon.
Crains tu le roy sans aguillon de hayne,
Aulx grandz seigneurs est vengeance inhumainne.

Appendix.

En grandz seigneurs, coleres et credules,
Ne vous fiez plus qu'en derriere de mules.

Vel.

(38, verso) Mansietude en prince avec justice
Joincte doit estre, aultrement seroit vice.

Vel.

Ung prince user de benevole face
Aulx humbles doibt, aux superbes d'audace.

95.—*Promissum regium.*

(stent) Stant fixa aeternum regalia sponsa per aevum,
Servanda exposcunt regia verba fidem.

Promesse de roy.

Ferme a jamais soit promesse de roy,
Il est requis aux roys garder leur foy.

Appendix.

Dieux terriens, sont dictz princes et roys,
Tout leur parler sont oracles ou loix.

Vel.

Quiconque accorde une requeste injuste
Rien ne promect quand la chose n'est juste.

Vel.

Qui promect cas que l'on doibt escondire
Ne promect rien, il ne faict que le dire

96.—*Voluptas et virtus.*

(39, recto) It male praestanti dispar virtute voluptas,
Hinc dolor aeternus inde perennis honor.

Volupté et vertu.

Volupté vile a vertu moult differe,
L'une doulleur et l'autre honneur confere.

Appendix.

Volupté gist en plaisir transitore,
Vertu en bien d'eternelle memoire.

Vel.

A nobles coeurs le vivre en liberté
Est trop plus doulx que vivre en volupté.

Vel.

Volupté mainne apres soy villennie,
Noble vertu, honneur, glore infinie.

Vel.

Ainsi qu'a lain on voit le poisson prins,
En volupté on voit mondains surprins.

97.—*Turpis et formosus.*

Turpis ut est pulchra facies virtute nitenda,
Sic nitida labes fronte linenda venit.

Le laid et le beau.

(39, verso) De corps deforme estainct vertu l'injure,
D'elegant viz convient purger l'ordure.

Appendix.

Deformité par vertu est couverte,
Et par vertu beaulté est plus apperte.

98.—*Puer fingendus ab optimo artifice.*

Cereus est docto fingendus pollice vultus,
(Prometheum) Ora prometheum pulchra venustat opus.

L'enfant doibt estre instruict d'un bon ouvrier.

Le jeune enfant ait maistre docte et saige,
Le bon ouvrier decore bien l'ouvraige.

Appendix.

Mainet precepteur parle bien de vertu,
Duquel le coeur est de vice vestu.

Vel.

C'est rien qu'avoir vertu en son langaige,
S'el n'est au coeur et en prendre l'usaige.

Vel.

En donnant maistre a ton filz, le langaige
Ne voy du tout mais regarde l'ouvraige.

Vel.

(40, recto) Du pere on voit enfans l'engin avoir,
Les escolliers du maistre le sçavoir.

Vel.

Le pere et mere aulx enfans donnent vivre,
Le precepteur bien vivre leur delivre.

99.—*Mens.*

(diffusa) Divina humanos mens est infusa per artus,
Cogitet ut spreto facta superna solo.

L'ame.

L'ame est au corps pour contempler les cieulx
En contempnant terrestres et bas lyeux.

Appendix.

Charnelz ont soing de l'homme exteriore
Bien preparer, l'effaus l'interiore.

Vel.

Pourceau l'ordure aux belles fleurs prepose,
L'homme charnel l'ame a son corps postpose.

100.—*Amicus reconciliatus.*

Gratia que coeat ficti male sarta sodalis,
(veluti) (Siculo Scylla) Est velut in siculo scylla cavenda mari.

L'amy reconcilié.

(40, verso) Fuy cestuyla comme peril en mer,
Qui t'a deceu soubz umbre de t'aymer.

Appendix.

Plus a craindre est l'ennemy familier
Seul, que ne sont aultres plus d'un millier.

101.—*Generosus.*

Acceptum duplici munus cum foenore reddit,
Vincitur haud larga mens generosa manu.

Le noble.

Au double rend l'homme, armé de noblesse,
Vaincre on ne peult noble coeur par largesse.

Appendix.

Dieu et le monde ingratitude en hainne
Ont grandement, car l'offence est villainne.

102.—*Metiende vires.*

Ardua ne subeas ignota pondera molis,
Ni bene sint tergi robora mensa tui.

On doibt congnoistre sa puissance.

N'entrepren fais trop ardu ne pesant,
Si tu ne sçais ton povoir suffisant.

Appendix.

(41, recto) Qui trop embrasse, on dict, que peu estrainct,
L'oeuvre imparfaict foul laisser est contrainct.

103.—*Nemo foelix ante obitum.*

Ne quisquam extrema foelix nisi morte vocetur,
(Croese) Instruis accenso Craese ligate rogo.

Nul homme eureux avant sa mort.

Cresus instruict par ung cas douloureux,
Qu'aulcun ne soit ains la mort dict heureux.
Appendix.
Mainct pensant boire, a la main tient sa tasse
Plainne de vin qui malgré soy s'en passe.

104.—*Gallie senatores.*

(Justitiae) Justicia e summo terras jove missa per omnes,
Gallorum elegit tecta verenda patrum.
Les senateurs de France.
Justice en terre envoyee de Dieu,
Chieux senateurs de France a prins son lieu.
Appendix.
Quand bien aymee est justice d'un prince,
Elle aura regne en toute sa province.

(Dares) 105.—*Ne dhares cum entello.*[1]

(41, verso) (Siculo Phrigius) Ne siculo phrigius cano decertet ephebus,
Fortius a lasso stant sola fixa bove.
Que Dares ne combate avec Entellus.
Arrogamment le jeune ne bataille
Contre le vieil trop rusé en bataille.
Vel.
Le jeune au vieil ne se vueille debattre,
Le vieil est ferme et rusé a combatre.
Appendix.
Pour la victoire avoir, plus faict prudence
Que ne faict force ou grande violence.

106.—*Soli christo qui est Alpha et Ω, honor et gloria.*

(litera) Prima rudimenti supremaque littera graii,
(Christe) Danda uni est dexter gloria christe tibi.
A seul Christ commencement et fin, honneur et glore.
Eternal Christ, fin, et commencement,
Glore et honneur soit a toy seullement.
Appendix.
Commencement et fin du tresparfaict.
Prent toute chose et sans luy n'est rien faict.
Fin des disthicques, leurs traductions et appendices.

[1] See the Aenead, Lib. V, 363-484.

XVII.

BALLADE DU BON ROY FRANÇOYS
LAQUELLE S'ADRESSE AULX FRANÇOYS :
LES PREMIERES LECTRES PRENDRES
DES LIGNES, ET VOUS APPRENDREZ
NOM, SURNOM, DU ROY EXALTÉ
PLUS QU'AULTRE DE LA CHRESTIENTÉ.

Françoys, ung franc Françoys en France
Regne sur vous, sans muer lettre
Avez ung nom ; vivre en souffrance
N'est veu les siens Françoys permectre ;
Changer juges, aultres commectre,
Ou justice voit variable,
Il veult les bons en biens acroistre,
Semblable aymer veult son semblable.

De nom, de lignee et naissance
Est Françoys, vostre roy et maistre,
Vous estez Françoys, Convenance
Avez grande, donc, debvez estre
(42, verso) Loyaulx vers luy et en tout estre
Ou serez de coeur amiable :
If fault ses amis apparoistre
Semblable aymer veult son semblable.

France, qui vis en ta plaisance,
Rend graces a Dieu qui fist naistre
Aulx Françoys, Françoys, qui nuysance
Ne te faict, ainsi que congnoistre
Chacun peult, mais soingneux faict mettre
Ordre partout, aulx bons affable,
Jecte les maulvais a fenestre,
Semblable aymer veult son semblable.

Prince Françoys, tenant le ceptre
Des Françoys en paix delectable,
Les bons aymez a vostre dextre,
Semblable aymer veult son semblable.

XVIII.

LES PREMIERES LECTRES PRENDRES,
ET FRANC FRANÇOYS VOUS APPRENDRES.

(43, recto) Fondé sur foy le bienfaict acquiert grace,
Rien ou bien peu vault le bien que l'en brasse,
(Ainsi qu'on dict), sans foy et sans credence ;
Nourrir pourtant de charité immense
Convient la foy, aultrement seroit crasse.

Foy de marchant est de grand efficace
Regnante foy, de gentilhomme passe
Auquel on donne ung tiltre d'excellence,
Fondé sur foy.

Nom de chrestien, et de treschrestien, place
Chez le Françoys a prins, sans qu'en desplace ;
Ou la foy est en grande reverence
Justice y est gardee en diligence,
Si le Françoys sçayt cas qui mal se face,
Fondé sur foy.

XIX.

(43, verso) JACOBI GALLI IN EUNDEM HEXASTICHON.

Torvum formidant animalia queque leonem,
Eximito gallum, quo tremit illa fera.
Pervigil est gallus, vel noctis tempora prodens,
Pro regno gallus dimicat usque ferox
Gallo cuique quadrant, quae dixi, pluraque multo,
Adficias regem proin quibus euloguis.

XX.

FRANCISCUS BOVILLUS MONTISMARIANUS IN TRALATIONEM DISTICHORUM FAUSTINORUM IN LINGUAM FRANCISCAM, AD LECTOREM.

En patrio Faustus misso sermone poeta,
Francigenas Francis vocibus adloquitur
Miretur quanquam, si quis modo sensus in illo est
Dedignaturam non tamon esse puto,
Disthica nam scripsit solis noscenda Latinis,
Disthica moratis inclita carminibus.

Nunc ea, vel vilis passim plebecula discit,
Hinc format mores rustica turba suos.
Optimus hoc Fausto tribuit Montanus ab ipso,
Sunt lepide in Francos disthica versa modos.
Sed regi hoc debet Faustus, nam precipue illi
Montani eximium scriptitat ingenium.
(44, recto) Montanium et doctos quoscumque amat, et foyet hic rex,
Huic debet musas Francia tota suas.
Debet ei pacem, debet foelicia secla,
Quid debet dicam ? debet et ipsa animam.

XXI.

Bâlade du Roy des Françoys,
Le premier de ce nom Françoys ;
Les premieres lettres prendrez,
Son nom et surnom apprendrez.

France a François, Françoys a France,
Roy, Françoys est, c'est ung bon heur
Auquel debvons toute obeyssance ;
Nous avons François pour seigneur,
C'est ung nom franc, doulx, sans rigueur,
Oultre, selon la saincte lettre,
Il convient aymer de bon coeur
Son Roy, son seigneur et son maistre.

De franc, François, nom de clemence
Est derivé pour sa doulceur,
(44, verso) Valoys est ung nom d'excelence,
Ainsi dict, Valoys, de valeur ;
Le bon Roy Françoys, franc donneur,
On ayme, et dedens son coeur mettre
Il convient en crainte et honneur,
Son Roy, son seigneur et son maistre.

France, nom de grande importance,
Region des aultres la fleur.
A prins de Francion nayssance,
Nay d'Hector des Troyens tuteur ;
Chacun Françoys, s'il n'est fauteur
Ou par trop meschant, recongnoistre,
Il doibt comme bon serviteur,
Son Roy, son seigneur et son maistre.

Prince, des coeurs vray pocesseur,
Tout le pays, sans fictif estre,
Aymé de coeur, soyez en seur,
Son Roy, son seigneur et son maistre.

(45, recto)

XXII.

Balade du concept virginal, allusion prinse sur ce mot de Valoys, en la personne de Marie.

Le Roy peult faire a son vouloir
Grace a l'un, l'autre faire pendre,
L'un ennoblist et faict valoir
En honneur, l'autre faict descendre :
Dieu, (que plus puyssant faulte entendre
Qu'ung roy lequel est sur les loix),
Pure en concept me voulut rendre
Puys qu'a Dieu pleut, je le valoys.

Pas n'estoys a equipoller
A Dieu pour en moy le comprendre,
Mais il luy pleut tant m'extoller
Que pour mere me voulut prendre,
Voulant qu'en moy n'eust que reprendre :
Raison ont donc Normans, Gaulois,
De mon concept pur entreprendre,
Puys qu'a Dieu pleut, je le valoys.

(45, verso)

Il n'est pas besoing, soit en parler
Ou en escript, du faict contendre
Lequel Dieu veult, qui peult par l'air
Et tous lieux sa puyssance estendre ;
Contre envieux, donc, voulans tendre
Me blasmer, soit maistre ou valletz,
Aultre raison ne veuil pretendre,
Puys qu'a Dieu pleut, je le valoys.

Envoy.

Prince, faictes resouldre en cendre
Mes maldisans, soient clerz ou laiz,
Pour ceste raison leur apprendre,
Puys qu'a Dieu pleut, je le valoys.

(46, recto)

XXIII.

Rondeau Joyeux a sa dame.

Les premieres lettres prendras
Et franc Françoys tu apprendras.

Faictes ainsy (Dame), comme j'entens
Rien envers vous qu'amitié ne pretens,
A vostre amy ce qu'il vous admonneste
Ne denyez, ce n'est cas deshonneste,
C'est que d'amours ayons le passetemps.

Femme entendu en amoureux contendz
Rend son amy du numbre des contentz,
A luy jamaiz n'escondit la requeste ;
Faictes ainsy.
Ne retardez (Dame), ce que j'atteus,
Cest fruict d'amours a aultre cas ne tens,
Ou le servant de bien servir s'appreste
Il est de droict que sa dame luy preste
Son domicile et houstilz competens ;
Faictes ainsy.

(46, verso)

XXIV.

"Christe qui lux es et dies."[1] (Traduict jouxte la lettre de la mesure et quantité d'icelle, qui est oraison convenable quand on se couche au soir.)

Christe qui lux es et dies noctis tenebras detegis lucisque lumen crederis lumen beatum predicans.

O Christ, lumiere et jour nommé,
De nuict les tenebres chassant,
Splendeur de lumiere estimé,
Heureuse lumiere annunçant.

Precamur sancte domine deffende nos in hac nocte sit nobis in te requies quietam noctem tribue.

Seigneur, sainct priaires faisons
Que ceste nuict nous soys aydant,
Et tousjours en toy reposons
Tranquille nuict nous concedant.

Oculi somnum capiant cor ad te semper vigilet dextera tua protegat famulos qui te diligunt.

Noz yeulz en repos soient rendus,
Les coeurs tousjours en toy veillans,
Par ta dextre soient deffendus
Serviteurs ton amour voulans.

[1] The Latin "oraison," which is given by the author in the margin, is taken directly from two Ambrosian hymns; the "Hymnus ad completorium" and the "Hymnus Vespertinus."

Ne gravis somnus irruat
Nec hostis nos surripiat
nec caro illi consentiens
nos tibi reos statuat.

De gref dormir ne soyons prins
Et du faulx ennemy surprins,
Qu'a luy ne consente la chair
Qui vers toy nous face pecher.

Defensor noster aspice
insidiantes reprime
guberna tuos famulos
quos sanguine mercatus es.

Regarde nous, vray deffenseur,
Noz ennemis soient repriméz,
Regi tes servantz soubz toy seur
Que de ton sang as rediméz,

Memento nostri domine
in gravi isto corpore
qui es defensor anime
adesto nobis domine.

Souvienne toy de nous, Seigneur,
Tant qu'en ce gref corps avons cours,
Qui de nostre ame es gouverneur ;
Soys present nous faisant secours.

Deo patri sit gloria
ejusque soli filio
cum spiritu paraclito
et nunc et in perpetuum.

Soit glore au pere createur,
A son fils semblablement,
Avec l'esprit consolateur,
Present et eternellement.

Maria mater gratie
mater misercordie
tu nos ab hoste protege
et hora mortis suscipe.

O Marie, mere de grace,
De misericorde aussi mere,
De nous le faulx ennemy chasse,
Pren nous l'heure de mort amere.

XXV.

Dizain de France et Italie.

Italiens ont moult France ennoblie
De deux grandz biens, de la langue latine,
D'un aultre bien qui vault qu'on ne l'oublie,
C'est de la sage et tresnoble daulphine.[1]
O France, France, a Dieu tu rendras grace,
Le suppliant que de temps longue espace
Soit la daulphine avecques le daulphin,
Et qu'ilz ne soient frustréz de leur attente
Par mort cruelle, en attendant la fin
Que du bon Roy nature soit contente.

[1] See page 92 of the Introduction.

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THE STATE WORKS OF PENNSYLVANIA

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V.—The State Works of Pennsylvania. By Avard Longley Bishop, Ph.D.

Introduction.

What is known technically in the history of Pennsylvania as the "state works" comprised a system of transportation which was built, owned and operated by the commonwealth. "Public works" and "internal improvements" are other names commonly applied to the system. The writer has, therefore, used these three terms interchangeably.

The popular movement for the state itself to provide an adequate means of transportation to the growing West may be said to have commenced in Pennsylvania in 1823. The work of construction was undertaken in 1826 and within a few years an extensive system of canals and railways was built and in operation. By 1859, however, there was not a single mile of public-owned canal or railway in the commonwealth. It is thus seen that the present study is limited to a definite field which furnishes an historical example of public ownership and control of a transportation system.

The material upon which this study is based was obtained principally from the state library of Pennsylvania at Harrisburg. The writer was given free access to the acts of legislature, journals of the house and senate, legislative and executive documents, reports and journals of the canal boards, pamphlets, newspapers, etc.,—in a word to all of the published and unpublished papers and documents which have any bearing upon the subject under consideration. The information gained from these sources was supplemented by other of a more general character, by visits to several sections of the abandoned works, and by conversation with a number of old residents of the state.

The above does not apply, however, to the material obtained for Chapter 1. This was taken largely from Hazard's "Register of Pennsylvania," especially Volumes I and II; from Carey's "Brief View of the System of Internal Improvements of the State of Pennsylvania" (1831); and from "The Canals of Pennsylvania and the System of Internal Improvements of the Commonwealth," by Theodore B. Klein, published in Part IV of the Annual Report of the Secretary of Internal Affairs of Pennsylvania for 1900. As

these sources have been freely drawn upon in the first chapter, which is introductory to the main thesis, specific references have not been given in all cases. Furthermore, in preparing the chapter on "Finance," many suggestions were obtained from Worthington's "Historical Sketch of the Finances of Pennsylvania" and from Nead's "Brief Review of the Financial History of Pennsylvania."

In making this study valuable assistance has been received from many persons. Although individual acknowledgments are not made in all cases, the writer by no means overlooks the obligation. My special gratitude is due to Professor G. S. Callender, who, in directing the work, has given invaluable counsel and criticism. I am also indebted to Professor W. G. Sumner for advice and suggestion concerning the matter and form of the present study. For many courtesies extended and for assistance rendered in locating material, I wish to acknowledge my indebtedness to Hon. Thomas L. Montgomery, State Librarian of Pennsylvania, and to his assistants.

Acknowledgment is hereby made of the assistance received from the Carnegie Institution of Washington in the collection of material for this monograph.

A. L. B.

New Haven, Conn., May 1st, 1906.

Chapter I.—Improvements in Transportation Before 1823.

For many years after the first settlements in the American colonies, the population was confined to a narrow strip of country along the Atlantic coast. The first census in 1790 showed that settlers from Maine to Georgia had spread themselves over a large part of the Atlantic plain and were climbing the mountains. The southeastern part of New York, eastern and southern Pennsylvania, and the eastern part of Virginia were the only sections of these states as yet settled. The average breadth of the populated area was 255 miles from the coast. Westward the lines of immigration were reaching out at four points,—up the Mohawk valley in central New York, along the Potomac through western Maryland, southwestwardly down the east Tennessee valley, and around the southern end of the Appalachian system in Georgia. Beyond the mountains the settlements were few. The most vigorous was around Pittsburg in western

Pennsylvania. Another existed in the northern part of Kentucky, and small ones along the Cumberland river in Tennessee and at the junction of the Kanawha with the Ohio river in what is now West Virginia. Excepting a few garrisoned posts, these were the principal western points yet reached east of the Mississippi.*

The beginning of the nineteenth century showed a marked change. The settled areas along the Atlantic coast had now become considerably broader, while the frontier in New York and Pennsylvania had been pushed back until about three-fourths of each state had been populated. Ohio had been occupied on both its eastern and southwestern borders, and the settlements in Kentucky and Tennessee had reached out towards each other until they now formed one large and flourishing community. A continuous chain of immigration extended also from the forks of the Ohio in Pennsylvania along its western border to Lake Erie.

By 1810 still greater movements were in progress, especially in the west. More than half of Ohio and large parts of Kentucky and Tennessee had been reclaimed from the wilderness. At the close of the second decade of the century, most of Ohio was settled and population was working its way rapidly into southern Indiana and Illinois, and southeastern Missouri.†

The westward movement, as yet inconsiderable compared with its later history, was now sufficiently important to attract the attention of the East, whose far-seeing citizens had early looked forward to the future economic importance of the vast region beyond the mountains. To secure for their own state a predominating influence in the trade of the West became at once the ambition of leading

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* These and the following facts concerning the distribution of population until 1820 have been gathered from Scribner's Statistical Atlas of the United States, the Census Reports, and the Statistical Atlas of the United States (1903) published by the United States Government.

† The Statistical Atlas of the United States (1903), p. 26, states that in 1790 not more than 5 per cent. of the population of the United States was west of the Appalachian mountains. Hence not more than 196,460 people were there at this time.

The census reports show that in 1800 the western states and territories contained 387,183 inhabitants; in 1810 the number was 1,075,398; and ten years later it had increased to 2,207,476. If we include the population of western Pennsylvania and Virginia in 1820, the total population of the West at this time was a little more than 2,600,000.

The total population of the United States was—in 1790, 3,929,214; in 1800, 5,308,483; in 1810, 7,239,881; in 1820, 9,633,822.

men on the Atlantic seaboard, particularly in New York, Pennsylvania, Maryland and Virginia. The peculiar topography of the country afforded but one natural outlet to tidewater, viz.—by the long route of the Ohio and the Mississippi to the Gulf.* The Allegheny mountains, separating the East from the West, were regarded as a formidable barrier to trade and communication. How to link those two sections of the country by an adequate transportation system was the problem.

In the early history of the colonies, before the movement westward had become of any importance, and when most of the population was confined to the coast and the immediate interior, the improvements in transportation were inextensive and of a local character. Roads had to be constructed through the forests, marshes made passable by causeways, and rude bridges thrown across the smaller streams. Later, appropriations were made to improve the navigation of the rivers. For a long time the only communications to the small western settlements were Indian trails along which no bulky goods could be carried. These in due course gave way to roads which for a time were considered adequate for trade and travel. But even before the West had come into prominence sufficient to present new problems in the field of transportation, the adaptability of canals to the needs of commerce, and their superiority over other known means of transportation, had been satisfactorily demonstrated. In the latter part of the eighteenth century, a few of the far-seeing men in Virginia, Maryland, Pennsylvania and New York conceived the idea of using them to supplement the natural water courses in reaching the Ohio valley and Lake Erie.† When the growth of the West had attracted public attention the rivalry of the adjacent eastern states for its trade was keen. Every one of the Atlantic seaboard cities had an

* The St. Lawrence route should not be overlooked, but less attention was given to it than to the one mentioned above.

† As early as 1754 George Washington in person explored a route to connect the east and west by the waters of the Potomac and Youghiogeny rivers. He also made a report to the colonial legislature of Virginia describing the obstacles to be overcome from Cumberland at the mouth of Wills' Creek to Georgetown. On the 20th of July, 1770, he made another report to the Governor of Maryland upon another route to the west at Pittsburg, and spoke of its importance, to use his own words, as "the channel of conveyance of the extensive and valuable trade of a rising empire." Later, he wrote of the political importance of opening a communication to the West, in that it

expert who could demonstrate beyond doubt that that particular port was in closest touch with Pittsburg and the West.* Agitators were ever ready with schemes for improvements that would positively ensure the state in question a predominating influence in the trade of the West.

Of this movement the building of the Erie canal was the climax. Its successful operation, and the consequent rapid fall in freight rates, necessitated the commencement of similar works in other states for the sake of their own self-preservation. The peculiar physical features of New York, making is unnecessary to over-top the mountains to reach the West, gave that state a decided advantage over all her competitors. It made defeat inevitable to Pennsylvania from the beginning, in spite of her advantage over New York in distance from the Ohio valley.

The later success of the Erie canal eclipsed all similar transportation achievements of other states. Their magnitude in Pennsylvania, though greater than in New York, failed to make an equal impression upon the imagination. The building of the state works not taking place until after the opening of the Erie canal also led many to infer that little attention was given by Pennsylvania to internal improvements until New York led the way. The error of such an inference will appear from the following summary of the activities of the state and of private companies in improvements in transportation before 1823, the date which marks the commencement of the popular agitation resulting in the building of the state works.

The history of the movement for internal improvements in Pennsylvania reaches back into the early records of the colony. William Penn, in 1690, recorded the practicability of artificially joining the Susquehanna and the Schuylkill rivers by means of their branches. This suggestion is found in a document entitled "Some proposals

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would be the best if not the only means of keeping the eastern and western countries together.—Pickell, A New Chapter in the Early Life of Washington, p. 172.

Many of the Washington documents regarding canals and internal improvement projects are found in Reports of Committees, House of Rep., Congress United States, 1st Session, 19th Congress; subject, "The Chesapeake and Ohio Canal," No. 228.

* Hulbert, Historic Highways, xiii, p. 173.

for a second settlement in the Province of Pennsylvania."* It is difficult to draw any satisfactory conclusions as to how Penn proposed to bring about the communication, but the fact is that a canal was commenced between these rivers exactly a century after the document referred to was written. If it was his idea to join the Schuylkill and the Susquehanna by a canal, Penn was far in advance of the age in devising means of internal transportation, for at this time canals were unknown even in Great Britain.

Nearly three-quarters of a century had yet to elapse before any movement for the improvement of the means of inland navigation of Pennsylvania crystallized into an act of legislature authorizing the same. The first activity was directed to the improvement of the rivers. Large sums of money were thus expended with little results before this device was supplemented by building artificial waterways.

The Schuylkill river was the first to receive attention. By Act of March 14th, 1761,† fifteen commissioners were appointed to make this waterway "navigable and passable for boats, floats, rafts, canoes and other small vessels from the ridge of mountains commonly called the Blue Mountains to the river Delaware." Power was also vested in them to receive and appropriate all moneys donated for this purpose. Supplementary acts‡ were passed from time to time appointing new commissioners. No general plan of improvement was carried through, however, until the formation of the Schuylkill Navigation Company, a private enterprise incorporated in 1815.

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* "It is now my purpose to make another *settlement,* upon the river of *Susquehannagh,* that runs into the Bay of *Chesapeake,* and bears about fifty miles west from the river *Delaware,* as appears by the *Common Maps* of the English Dominion in *America.* There I design to lay out a *Plan* for the building of another *City,* in the most convenient place for communicating with the former plantations on the *East;* which by land, is as good as done already, a way being laid out between the two rivers very exactly and conveniently, at least three years ago: and which will not be hard to do by water, by the benefit of the river *Scoulkill*: for a *Branch* of that river lies near a *Branch* that runs into the *Susquehannagh* River, and is the *Common Course* of the *Indians* with their *Skins* and *Furrs* into our Parts." See Haz. Reg., I, p. 400.

† Smith's Laws of Pennsylvania, I, p. 235.

‡ February 26th, 1773; March 24th, 1781; March 15th, 1784.

The works of this company extended 108 miles up the Schuylkill from Philadelphia. Connection was made with the Union canal at Reading. This improvement was effected by converting the channel into slackwater by building thirty-one dams. Tolls were first taken in 1818, amounting to $233. By 1825 they had increased to $15,776, of which $9,700 were received from coal. The Schuylkill coal industry now had a rapid expansion. By 1823, only eight years after its commencement, the company's tolls amounted to $325,468, of which the sum of $228,000 was derived from coal alone. Much of the balance came from return freights from Philadelphia on supplies for the mining districts. The report of the company for 1865 showed that 1,000 boats with an average capacity of 170 tons passed to and fro through the canal, carrying 1,500,000 tons of coal, lumber, iron ore, etc. The cost of the line had been $12,500,000 and a dividend of six per cent. was being paid. Time, however, brought great changes in the method of transportation, and eventually a rival, the Philadelphia and Reading Railroad, obtained control over it through a long lease. The Schuylkill Navigation Company remains as one of only four canal and navigation companies that now report to the Secretary of Internal Affairs.

The present condition of the works has been described as follows:—

"The canal itself has become a memory, the corpus being valuable only as a possible asset in case a sale should be made for waterworks purposes. For the last few years not more than two or three canal boats have passed daily through the lock at the head of Fairmount pool. The wooden locks are but rotting timbers; the pools are shallow basins, filled with the debris of coal mines; the skeletons of its boats lie bleaching on the shores of the beautiful Schuylkill, the few that are left floating being but sad reminders of the first great transportation enterprise of the Keystone State."*

Many efforts were made to improve the navigation of the Susquehanna river previous to the commencement of the state works. Large sums of money were expended in removing rocks, deepening channels, and building wing walls, yet the benefit derived from such labor was scarcely perceptible. In the year 1793 a company was incorporated to make a canal around the Conewago Falls on the west side of the river in the county of York.

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* Scott, Memoir of Charles E. Smith, p. 39.

This work extended a mile and a quarter, overcoming a fall of 21 feet, and was executed at an expense of $100,000. In the year 1813 an act was passed authorizing James Hopkins of Lancaster county to make a canal for the same purpose on the east side of the river; accordingly, in 1814, two dams, one of 800, the other of 500 feet, were built. The canal was one mile in length and was excavated out of rock. The ascent of 21 feet was overcome by one guard and three lift locks, each 110 feet long and 18 feet wide. The cost of the work was $120,000. The water power obtained from these two canals was the chief inducement which prompted their construction.

The river Lehigh also received considerable attention from the advocates of internal improvements. Its importance as a highway for internal navigation was not overlooked either by the state or by private individuals. It was declared a public thoroughfare in 1771. Private subscriptions were made at an early date to improve its navigation, and commissioners were appointed to appropriate and expend the money. What amount was raised is unknown but it was probably inconsiderable. By Act of April 13th, 1791,* the legislature appropriated 1,000 pounds to be expended on the Lehigh "from its junction with the Delaware as far up the same as the sum would admit." On February 27th, 1798, a company was incorporated to better its navigation and a lottery authorized to help obtain the desired funds. No improvements appear to have been made at this time. A few years later Messrs. Josiah White, George F. A. Hauto and Erskine Hazard became interested in transportation schemes and secured the passage of a law on March 20th, 1818, granting them certain rights and privileges concerning the improvement of the Lehigh. These were later confirmed to them and their successors by the incorporation of the "Lehigh Coal and Navigation Company"† on February 13th, 1822.

In the early history of the company, the river was used only for a descending navigation. The coal and lumber of the country drained by the Lehigh were brought to market in arks which were broken up and sold upon their arrival in Philadelphia. Later it was decided to increase the navigability of the river by building

* Laws (Ms.), No. 4, p. 188.

† The privilege of both mining and transporting coal was granted to this company, whereas the Schuylkill Navigation Company had no mining privileges.

a series of locks. The amount expended for this purpose and in improvements of every description, including opening the Mauch Chunk coal fields, dwellings, mills, railroads and turnpikes, up to January 1st, 1828, was $875,718.79.* The act of incorporation of 1822 contained a proviso that the total sum at any one time invested in land should not exceed $60,000. The maximum capitalization was also fixed at $1,000,000. In later years, when increasing business came to require it, these restrictions were removed. The company is still in existence with a capitalization of $15,801,300. It owns various properties, including coal fields and a main line of canal 48 miles in length extending from Coal Port to Easton.†

A successful enterprise looking towards the improvement of navigation on the western waters of the state was incorporated by the legislature on the 24th of March, 1817, under the name of "The President, Managers, and Company of the Monongahela Navigation Company." This act appointed commissioners to receive subscriptions to 1,600 shares of stock at $30 each, as a capital for improvements in navigation on the Monongahela river. It was proposed and authorized in the act of incorporation to construct sixteen dams across the river from the state line to its mouth, a distance of ninety miles. This would form a slack water navigation, and locks connected the pools. The sum of $30,000 was subscribed by the state and $18,360 by individuals. The work was commenced in 1821, but little progress was made before operations were, for the time being, suspended. Several years later, however, work was resumed, and in 1890 the official report showed that the capital had reached the sum of $1,630,000, upon which a handsome dividend of 9 per cent. was paid. The work, however, is maintained now free of expense to the shippers of the various products of the Monongahela valley, for in 1897 the government of the United States, by proceedings in condemnation, acquired possession and control of the company.

During the few years immediately preceding, and closely following the American Revolution, many plans were brought forward in Pennsylvania for improvements in transportation. These were not only of a local character but provided also for the development

* Haz. Reg., I, p. 414. This figure does not include the money expended in buying real estate.

† Report Pennsylvania Department Internal Affairs, 1903-04, iv, p. 712.

of outlying territory. It was even proposed to unite the waters of the Atlantic with those of the Ohio and Lake Erie by a chain of interior navigation.* In his message to the legislature in 1790, Governor Thomas Mifflin said:—

"The very laudable attention paid to the survey of roads and rivers is conclusive proof of the importance of the object, while it furnishes an example highly deserving of your imitation. Every day, indeed, produces an additional incentive to persevere in improvements of this kind. The commercial policy of insuring the transportation of our produce from the interior counties to the capital is dependent upon the ease and facility of the communications that are established throughout the state; and when we consider Pennsylvania not only as the route that actually connects the extreme members of the Union, but as a natural avenue from the shores of the Atlantic to the vast regions of the western territory, imagination can hardly paint the magnitude of the scene which demands our industry, nor hope exaggerate the richness of the reward which solicits our enjoyment."

In harmony with the trend of popular feeling, there was formed at Philadelphia in 1789 "The Society for promoting the improvement of Road and Inland Navigation," composed of enlightened citizens from various parts of the state. Within two years it had a hundred members. The meetings were held Monday evenings during the sessions of the legislature to suggest schemes and proposals for promoting trade and communication between the different parts of the state and of the Union. On February 7th, 1791, this society, of which Robert Morris was president, presented a memorial† to the legislature containing a detailed and comprehensive view of the various routes suitable for roads and canals from the seaboard to the interior of the state, the West and Lake Erie, and the adjoining states. Maps and estimates of expenses necessary to build the proposed lines of communication were also furnished. This memorial is an important landmark in the early history of transportation in Pennsylvania, showing clearly the elaborate scheme of internal improvements contemplated by its originators. In the light of later developments, that part proposing to connect the eastern waters with those of the Ohio and Lake Erie is peculiarly interesting, in that it shows conclusively that, long before connection had been made with the West by the Erie canal, public-

* Haz. Reg., I, p. 409.

† Full text of this memorial in Haz. Reg., II, pp. 119-122.

spirited citizens in Pennsylvania had conceived this idea as practicable,* and had surveyed routes, and estimated their expenses. Moreover the course followed later in building the main line of the state works was, roughly speaking, the one recommended by the memorialists. The care with which the route had been determined at this early date, the exact survey, and the distances between the various connecting points are shown by the following table† :—

	Miles.	Chains.
"[From Philadelphia] up Schuylkill to the mouth of the Tulpehocken,	61	00
Thence up Tulpehocken to the end of the proposed canal,	37	09
Length of the canal,	4	15
Down Quitipahilla to Swatara,	15	20
Down Swatara to Susquehanna,	23	00
Up Susquehanna to Juniata,	23	28
Up Juniata to Huntington,	86	12
From Huntington, on Juniata, to the mouth of Popular Run,	42	00
Portage to the Canoe Place on the Conemaugh,	18	00
Down Conemaugh to Old Town at the mouth of Stony Creek,	18	00
Down Conemaugh and Kiskeminetas to Allegheny River,	69	00
Down Allegheny River to Pittsburg on the Ohio,	29	00
	426	04"

The estimated expense of putting through the entire work from Philadelphia to Pittsburg was a little less than $2,000,000. When Pittsburg had once been reached, it was regarded as a comparatively easy matter to tap Lake Erie through Allegheny river and French creek.

In recommending the opening of a commercial channel by this route the memorialists pointed out to the legislators that they would thus execute a work of the first rank for the honor and advantage of their state. It would, in their opinion, combine the interests of all its parts and cement them into a perpetual commercial and political union. Moreover the future importance of the trade of the territory beyond the mountains was a further motive that weighed heavily with them, impelling them to exert all possible pressure upon the legislature to provide means for its outlet. That the rivalry between the eastern cities for its control would be keen,

* The idea of the memorialists regarding the western connection was to put through a main line of water communication between Philadelphia and Pittsburg excepting a portage of eighteen miles over the Allegheny mountains.—Haz. Reg., II, p. 122.

† Haz. Reg., II, pp. 119-120.

was not overlooked; but that Philadelphia might secure the major part of this trade if adequate transportation facilities were provided, was hardly questioned. We shall see later how wide of the mark this prediction proved to be. Their opinions in this matter were based upon the advantage in distance (considering Pittsburg as the point of entrance to the Ohio valley) possessed by Philadelphia over other ports on the Atlantic. With this advantage, they believed there could be no doubt that the transportation of all kinds of commodities from Philadelphia to Pittsburg might be effected "at a much cheaper rate than from any other seaport on the Atlantic coast." The time was not yet ripe, however, for the government to undertake at once so extensive a programme of improvements as here proposed. However, as we shall soon see, some provisions were immediately made to better several local lines of transportation.

Stimulated now by the recommendations of Governor Mifflin in his message of 1790 and by the efforts of the improvement society, the legislature appointed a board of commissioners to explore the western waters, the Susquehanna, the Delaware, etc. On January 5th, 1791, the same body appointed a committee to examine their reports,* and, with the information contained therein as a basis, to recommend plans for improving the roads and navigation of the state. The report of this committee† was presented to the legislature on February 19th of the same year. It was unanimously recommended that some action should be taken by the government to improve at once the navigation of the most important rivers of the state, and to build roads and portages for the purpose of facilitating transportation between them. Estimates also of the expense anticipated in making each of the improvements were submitted. The importance of providing a direct line of water communication, except at the Allegheny portage, to connect Philadelphia with the western waters and the great lakes was not overlooked. In short, the programme submitted as timely for the adoption of the government was such as would provide the various parts of the state with easy and cheap transportation for local traffic, and improved facilities for reaching the West. The

* Full reports of these commissioners are published in an appendix to the Journal of the House of Representatives for 1815-16.

† Full report in Haz. Reg., II, pp. 129-132.

entire expense of effecting the improvements as submitted by the committee was 60,870 pounds.

In accordance with this report and in harmony with the popular sentiment, an Act* was passed on the 13th of April, 1791, appropriating 23,320 pounds for local improvements. The work authorized to be done consisted principally in removing obstacles from the rivers and otherwise making them more navigable, and in building roads to connect the links along the natural lines of water communication. The money appropriated for these purposes was required to be expended by the Governor contracting "with individuals or with companies."

Another important transportation enterprise originating early in the history of Pennsylvania was the Union canal between the Schuylkill and the Susquehanna. The advantages to be derived from opening such a communication had attracted the attention of enlightened men by the middle of the eighteenth century. In 1762, David Rittenhouse and Dr. William Smith surveyed and levelled a route for a canal† between these rivers via the Swatara and Tulpehocken creeks, and the practicability of building it was satisfactorily demonstrated. This was probably the first scheme of its kind to be seriously discussed in the colonies,‡ and it was to a similar route that William Penn had referred in 1690. In 1769 and 1770, a committee of the American Philosophical Society re-examined the original surveys and three years later the legislature appointed a committee to do likewise.§ All agreed upon the one route for the canal. The formidable nature of the proposed works under colonial economic conditions, their novelty in this country, and still more the outbreak of the Revolutionary war, prevented their immediate construction.

At length by Act of September 29th, 1791,‖ a company was incorporated to open a canal and lock navigation between the Schuylkill and the Susquehanna by the route already determined. The intention of later extending the work to the western and

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* Laws (Ms.), No. 4, p. 188.

† Haz. Reg., 1, pp. 409-10. Tanner, Canals and Railroads of the United States, p. 95.

‡ Haz. Reg., I, p. 409. Hulbert, Historic Highways, xiii, p. 22.

§ Breck, Sketch of Internal Improvements already made by Pennsylvania, p. 57. Carey, Brief View of Internal Improvements, p. 2.

‖ Laws (Ms.), No. 4, p. 234.

northwestern counties of the state was expressed in the act. On April 10th, 1792, another act* was passed creating a company to open a water communication between the Schuylkill and the Delaware. The idea of its promoters was to build a canal seventeen miles long from Norristown to Philadelphia. It was also their intention to make a temporary improvement of the Schuylkill between Norristown and Reading, and thus form an uninterrupted water communication with the interior of the state and the West.

It soon became clear to the two companies that, in consequence of the difficulties encountered in improving the channels of the rivers, the canals should be longer than they had anticipated. Hence the Susquehanna and Schuylkill Company, at the suggestion of a British engineer named Weston whom they had imported for their service, determined to extend their canal from river to river, a distance of about seventy miles. The two companies united their forces and completed about fifteen miles of the most difficult parts of the two works, but, on account of financial difficulties, both were compelled to suspend operations after the expenditure of $440,000.† These magnificent projects, worthy of the influential citizens by whom they were conceived, were defeated partly by the want of public spirit among capitalists, but largely in consequence of the spirit of ruinous speculation. For they were ushered before the public not long after the historic speculations following upon the organization of the federal government, in public securities, in the stock of the Bank of the United States, and in public lands. Fortunes were realized from the first two of these schemes by most of those who engaged in them; equally large ones were anticipated by those who speculated in public lands. It was believed that canal stock would at this time rise in the same manner as other stocks had risen, and that they would thus afford a good chance to make money. The result was that there was a struggle for an opportunity to subscribe. Accordingly, a large proportion of the shares were taken by persons who were wholly unable to pay up the remaining instalments and who never contemplated doing so. Their object was to sell out at once whenever an advance took place. In this they were sorely disappointed. There were no purchasers, and instead of making money, the original subscribers forfeited their first pay-

* Laws (Ms.), No. 4, p. 510.

† Haz. Reg., I, p. 410.

ments. Partial success attended the attempt to enforce the payment of the remaining instalments from those who were solvent.*

The project, however, as we have already seen, had to be abandoned. The suspension of these works exercised a most disastrous effect upon every similar work projected for many years afterwards.

These two companies were kept alive by Charles Palaski, who called meetings of the members and had officers and managers appointed, until, by Act of April 2d, 1811, the original companies, composed largely of the same individuals, were reorganized and united under the name of "The Union Canal Company." For several years following the act of amalgamation, it lingered in a state of comparative inactivity. At length, however, after encountering various difficulties and discouragements, the canal was completed and a communication opened in May, 1827, between Reading and Middletown.

In the act of 1811 forming the Union Canal Company, the president and managers were specially authorized to extend their canal from Philadelphia to Lake Erie, with the privilege of making such further extensions in any other part of the state as they deemed expedient.†

In order to resume operations with the prospect of success large sums of money were needed. The work lingered on for several years after 1811, until helped by the state. By an Act passed March 29th, 1819, the latter granted an interest of 6 per cent. to subscribers of the stock that might be sold to recommence the work. This was to be taken from the proceeds of a lottery. By an additional Act of March 26th, 1821, the state guaranteed this interest by a pledge to supply any deficiency in it which the lottery could not produce. The new subscriptions which were obtained by this legislative encouragement enabled the managers to resume operations in 1821 and to complete the whole work in 1827.

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* See Carey: Brief View of the System of Internal Improvements of the State of Pennsylvania, pp. 4, 5, 6, et seq.

† Section XXX. "And be it further enacted by the authority aforesaid, That it shall be lawful for the President and Managers of the 'Union Canal Company of Pennsylvania' as soon as they may think proper, to extend this route to communicate with Lake Erie or other waters of any neighboring state by canal and lock navigation, ..."—Laws of Pennsylvania, 1810-11, Chapter cxxxvi, p. 238.

The Union canal was seventy-seven miles long, exclusive of various pools and navigable feeders. It extended from Middletown on the Susquehanna to a point on the Schuylkill a short distance below Reading. At Middletown it connected with the Pennsylvania canal leading to Pittsburg and Erie, to Tioga in the north, and to Bald Eagle creek on the west branch of the Susquehanna. At Reading it connected with the works of the Schuylkill Navigation Company leading to Philadelphia.

"Large quantities of iron ore from the Cornwall banks of Lebanon county were shipped to Danville and other points via the Union canal, and coal was returned from the Wyoming region for use in the furnaces at Lebanon and vicinity as back-loading." After its enlargement, lumber from the west branch region of the Susquehanna came through it for a time in order to avoid towage charges on Chesapeake Bay. "But the delays incident to the frequent lack of sufficient water and the great amount of lockage were detrimental to the shippers and carriers. At last, in 1885, the officials of the company reported: 'The Union canal is *non est,* it having been sold out, property and franchise, by the sheriff of Philadelphia.' It had borne the brunt of flood and financial panic for almost three-quarters of a century, having been in operation before the canals of the commonwealth. The work was abandoned and sold for a song, including the masonry of one hundred lift locks, three guard locks, with buildings, machinery and pumps, all of which had cost more than $6,000,000, which melted away from the estates of widows, orphans and capitalists all over the commonwealth."*

We have now given a summary of what was done in Pennsylvania in the line of internal improvements by canal and navigation companies and by the state in improving water-ways previous to the beginning of the popular movement resulting in the execution of the state works. In addition to the numerous improvements made by canal and navigation companies, there remains yet to mention what was done during this period in building turnpike roads and bridges. Here the best information is furnished by a report of the Committee of Roads, Bridges, and Inland Navigation† submitted to and read in the senate of Pennsylvania on

* Klein, Canals of Pennsylvania, p. lxxiv.

† Report on Roads, Bridges and Canals, 1822.

March 23d, 1822. This report was prepared in response to the following resolutions passed by that body on January 4th, 1822:—

"*Resolved,* That the committee on roads, bridges and inland navigation be instructed to ascertain, as far as is practicable, and report to the senate, a list of the turnpike road companies, incorporated by the legislature of Pennsylvania, the amount of the state's subscription to each, the number of miles of each already completed, the counties in which located, the expenses of constructing the same, the nature, width, and depth of the materials of which they are composed, together with such information, relative to the improvements which have been made in the mode and economy of constructing turnpike roads as will, in their opinion, be useful to the legislature."

"*Resolved,* That the same committee also be instructed to ascertain, as far as is practicable, and report to the senate, a list of the bridge, canal, and lock navigation companies, incorporated by the legislature, the amount of the state's subscription to each, the cost of and progress made in constructing the same, together with such other information relative to the subject of roads, bridges and inland navigation, as may present a complete view of the actual extent of internal improvement."

As no official document giving an entire view of the extent of the state's internal improvements existed anywhere at this time (1822), it was impossible to collect the information called for by the preceding resolutions without the aid of the officers of the respective companies concerned. Accordingly, after having completed their lists, the committee addressed a circular letter to the president and managers of each corporation with a request that they should furnish the desired information by answering a series of questions enclosed. Satisfactory answers were returned in nearly all cases. A large amount of information respecting the companies was consolidated into tables accompanying the report.

From an inspection of these tables, it is found that the number of turnpike roads contemplated by the various charters of the companies which had received letters patent was 2,521¾, of which 1,807 were completed. About 1,250 miles of these roads were of solid stone. The amount of capital subscribed towards these improvements by individuals (including the subscriptions of a few banks) which had been paid or was expected to be paid was $4,158,347. The amount subscribed by the commonwealth was $1,861,542. The report of the committee stated that if there were added to these sums one-half the amount of the existing debt of

the companies, say, $381,585, which it is probable the roads had cost more than the amount subscribed by the state and solvent individuals, it would appear that to turnpike roads there had been subscribed and appropriated up to 1822 in the State of Pennsylvania the sum of $6,401,474.

The works completed or in progress at that time provided for two stone roads between Philadelphia and Pittsburg, one of which had already been finished; one continuous road from Philadelphia to the town of Erie on the lake of the same name, passing through Sunbury, Bellefonte, Franklin and Meadville; two roads, with a deficiency of but a few miles of turnpike, from Philadelphia, one to New York state line in Bradford county, passing through Berwick, the other to the northern part of the state in Susquehanna county passing through Bethlehem; and a continuous road from Pittsburg to Erie via Butler, Mercer, Meadville and Waterford. The completion of these lines insured the northern, northwestern and western sections of the state connection with the metropolis, and, in the opinion of the framers of the report, would "afford facilities for traveling and transportation unequalled, as to extent, in the United States."

With reference to bridges, also, a large appropriation had been made. Private individuals had subscribed to $1,629,200 worth of stock, and the commonwealth to the amount of $382,000. If to these sums one-half of the amount of the debts be added, as in the former case, the amount contributed to the construction of bridges totalled $2,051,795.

So far as navigation companies were concerned, the commonwealth had subscribed $130,000 out of a total of $1,916,510 appropriated for constructional purposes.

If all these subscriptions and appropriations be added together, the amount shown to have been applied towards all kinds of improvements in transportation in Pennsylvania before the beginning of the popular movement in 1823 was nearly $10,500,000. This amount was expended by the *state* and by *corporations* (largely the latter) exclusive of various sums large and small spent by the counties on roads, bridges, and other improvements; an amount which, though liberal, it is impossible to determine, owing to the loss of many county documents and to the confusion of counts.*

* Haz. Reg., I, p. 408.

The foregoing review warrants the conclusion that in matters of improvements in transportation facilities the policy pursued was liberal and progressive. Actuated by an enlightened public spirit, numerous charters for turnpike roads, bridges and navigation companies had been granted, many of which were subsidized with public funds amounting to a total of $2,373,542. By pursuing this policy, the state had strongly stimulated the activities of numerous liberal-minded citizens in their efforts to keep abreast of the times. We have seen further that the early champions of internal improvements, long before the Erie canal was projected, not only had conceived the idea of connecting the eastern and western waters by a navigable route of communication, but also had carefully surveyed the proposed line and made estimates of the expenses incident to its construction. While Pennsylvania and her southern neighbors *thought* seriously about this scheme, the enterprising citizens of their sister state, New York, were *actually constructing* a similar work with all consistent speed. Their example in this connection was a powerful factor in precipitating the movement in Pennsylvania. Accordingly, before the completion of the Erie canal, there arose in that state a widespread and vigorous popular agitation for a through waterway to the West. It is to an examination of this movement that we next turn our attention.

Chapter II.—The Popular Movement for Internal Improvements.

The close of the first quarter of the nineteenth century was marked by vigorous efforts on the part of many states of the Union to improve their transportation facilities. The commercial cities on the Atlantic seaboard had watched with interest the growth of the West and the rapid expansion of its trade soon after 1815. Yet, apart from local sporadic movements, no very serious attention had been paid to the matter of a better western communication. To this end, however, these cities now became the leaders of popular movements in their respective states. In the West, the transportation enterprises proposed, and later carried through, were scarcely less numerous or important.* The principal works

* "It is reported that, from an actual examination of the subject, no less than 102 canals are made, making, and projected in the United States." Niles' Reg., XXX (July 1, 1826), p. 317.

built were designed to connect the Great Lakes with the Ohio and the Mississippi rivers. The minor works were either branches of the main lines, or short ones to provide outlets for the trade of the interior of the states. Before entering upon a discussion of the movement in Pennsylvania, an examination of the causes giving rise at this particular time to the general activity of the eastern and western states in transportation improvements demands attention.

In spite of the large immigration into the West before 1815, its economic importance until then was comparatively inconsiderable. This was due largely to the fact that the conditions governing the prosperity of newly-settled regions were absent.* Isolated from the markets of the eastern seaboard, the western farmers were obliged to send most of their surplus produce down the Mississippi. The route was long and dangerous, and there was indeed little demand for their commodities in the sparsely settled districts along the lower course of the river. Hence most of their exports had to be sent to market around by sea to the Atlantic cities or to foreign countries. The value of these shipments was small.† Local manufactories existed turning out such articles as were necessary for the simple economy of the western settlements. Yet even under these conditions, here and there in the Atlantic states, especially in the cities along the coast, groups of far-seeing citizens could be found who believed that the West had a bright future. Many had abundant faith in its possibilities. But its trade was relatively too unimportant, as yet, to attract the attention of the greater proportion of the population.

Soon after the war of 1812, however, two events occurred which profoundly affected the development of the West. The introduction of the steamboat and, by 1817, its common use upon the Mississippi and its tributaries, brought the West into easy communication with the seaboard. The result was an immediate increase of trade.‡

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* An excellent discussion of these influences, their absence in the West before 1815, and the circumstances giving rise to the economic importance of the West after that date is given by Prof. G. S. Callender in the Q. J. Ec., xvii (1902-03), pp. 116-137.

† Roads, of course, led over the mountains to the eastern seaboard, but very few articles would pay for their conveyance there by land. Live stock, however, was frequently driven to the eastern market.

‡ "This commerce is already [1818] very great and fast augmenting. As an example of the constant and increasing movement on the Mississippi and

But what was even more significant was the fact that the spread of cotton culture into the southwest had now given to the states of the northwest their first important market. These two events happening about the same time furnished the necessary conditions for a speedy development. A lively trade now sprang up between the farmers of the northwest and the southern cotton planters. The absence of complete and reliable statistics makes it impossible accurately to determine its extent, but they are sufficient to establish the belief that it was large, and also that it grew up almost entirely after 1815.*

The states on the Atlantic seaboard were soon engaged in a keen rivalry for the trade of the West. Since commercial expansion or obliteration depended upon success or failure in this contest, their capital cities entered upon the struggle with tenacity of purpose. It is scarcely necessary to mention the fact that the outcome must depend upon the question as to which one of these states could provide the quickest and cheapest route of transportation. Hence those who had long advocated such improvements soon found themselves in the midst of a popular movement for better transportation facilities to the West. New York took the lead and on July 4th, 1817, the first excavations were made for a canal between Rome and Utica. In October, 1825, the through line was completed and the city of New York was united with the Great Lakes by a stretch of navigable waters via the Hudson river and the Erie canal.†

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its tributary waters, and of the immediate advantages to be derived to us by connecting those waters with the Susquehanna, by means of the Allegheny river, I will state that there will be thirty steamboats this year [1818] on the Mississippi and its tributary streams: 594 flat-bottomed boats and 300 barges arrived at New Orleans from the upper country in the year ending October 1st, 1816; 1500 flat-bottomed boats and 500 barges, ditto, in the year to October 1, 1817. A large proportion of this came from the waters which could be united with the Susquehanna, and of course would come to the Philadelphia market."—Breck, Sketch of Internal Improvements already made by Pennsylvania, p. 76.

* Callender, State Enterprise and Corporations, in Q. J. Ec., xvii, 1902-03, p. 128.

† Soon after the completion of the Erie canal the state supplemented it with an extensive system of canals reaching many parts of the state. Note that in New York the through line to the West was built first.

The worthy example of New York, as has been said, was a strong factor in arousing Pennsylvania to action. Scarcely had the Erie canal been commenced before signs of the approaching popular movement appeared. Numerous articles were published in the newspapers or were circulated in pamphlet form for the purpose of impressing upon the public the need of a canal to compete with New York. A pamphlet written by a state senator* from Philadelphia deserves notice. The writer set forth in the strongest language, "the superior situation of Philadelphia, geographically considered, for the attraction of the great and increasing trade of the countries bordering on the Susquehanna, the lakes and the western rivers." He compared the distances from Pittsburg to New York and Philadelphia, and showed a handsome margin in favor of the latter.† The resources of the two states were contrasted to the advantage of Pennsylvania. The New York canal commissioners were quoted to the effect that they expected from the Erie canal a revenue from which "the whole expense of this magnificent operation would be defrayed in a few years, and an immense revenue would be secured to the state. This would enable it to patronize literature and science, to promote education, morality and religion; to encourage agriculture, manufactures and commerce; and to establish the interest of human improvement upon an imperishable basis and to an incalculable extent." If these results were confidently expected in New York, the outlook in Pennsylvania was certainly more promising. Unless immediate action were taken, however, the natural advantages of the latter state were bound to be outweighed by the promptitude of New York.

With reference to Baltimore as a rival, the situation was also alarming. Via the new national road, that city was ninety miles nearer the Ohio valley than was Philadelphia. Moreover the road was over a part of its length free from tolls,‡ while heavy fees had to be paid upon the whole distance from Philadelphia to Pittsburg. To protect the commerce of Philadelphia, in the face of competition from both the north and the south, the need of a

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* Breck, Sketch of Internal Improvements already made by Pennsylvania (1818).

† He estimated the distance from Pittsburg to New York at 766½ miles; from Pittsburg to Philadelphia, 423 miles.

‡ It was toll free between Fort Cumberland and Brownsville, a distance of 72 miles.

navigable water communication to the West was so urgent* that, if necessary, she ought to build it alone. The views thus set forth, and the arguments used, were indicative of a feeling shared by many, especially in Philadelphia.

The movement spread gradually, and soon it began to be reflected in speeches and resolutions in the legislature. On January 3d, 1823, Dr. William Lehman† proposed the following resolution in the house, which was adopted:—

"*Resolved,* That the Committee on Roads and Inland Navigation be instructed to consider the expediency of appointing commissioners, whose duty it shall be to furnish annually to the Legislature in the early part of the sessions a properly digested view of the state of the roads, bridges and watercourses of the state; and also to cause to be explored the route between the Schuylkill and Susquehanna through the great valley of Chester and Lancaster counties and also the most suitable routes between the waters of the Susquehanna, the Allegheny, and Lake Erie, for the purpose of ascertaining the practicability and the probable expense of connecting these streams by a water communication."‡

On February 24th, the committee reported a bill entitled "An Act providing for the appointment of a board of commissioners for the purpose of promoting the internal improvement of the state." No immediate action was taken. On the 5th of December of the same year, however, it was referred to a special committee§ and two weeks later this committee reported‖ that examinations and surveys ought to be made at once for a main route of water communication between the Susquehanna and the Allegheny rivers. This opinion was formed only after a careful consideration of the favorable geographical and material endowments possessed by Penn-

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* The movement even in its commencement was first to build a main line of communication to the West.—"To counter-act these threatened evils, we must furnish a *cheaper* water intercourse by some of the routes hinted at. . . . We must work our way to the Susquehanna, and thence to the Allegheny first and we must go about it soon too."—Breck, Sketch of Internal Improvements already made by Pennsylvania, p. 70.

† Dr. Lehman was one of the most earnest advocates that could be found in the state for the adoption of a system of internal improvement. At this time he was chairman of the committee of roads and inland navigation.

‡ J. H. Rep., 1822-23, p. 186.

§ Messrs. Lehman, E. Lewis, Reynolds, Hummell, Diven, Maclay, Ogle, Clarke and Everhart.—J. H. Rep., 1823-24, p. 82.

‖ Full text of Report in J. H. Rep., 1823-24, pp. 163-170.

sylvania; and of the urgent necessity of keeping pace with the states to the north and to the south to prevent commercial extinction.* As a preliminary step to the system of transportation improvements which they felt to be impending, the committee urged the legislature to consider favorably the bill providing for the appointment of a board of commissioners. After numerous discussions, it passed both houses† and received the approval of Governor Shultze on March 27th, 1824.‡

This act authorized the governor to appoint three commissioners to explore routes for a canal from the East to Pittsburg. Three possible routes were to be examined,—one via the waters of the Juniata and Conemaugh rivers; a second through the west branch of the Susquehanna, the Sinnemahoning and the Allegheny; the third, via the upper waters of the Schuylkill, Mahony creek, the Susquehanna, the Moshannon or Clearfield and Black Lick creeks, the Conemaugh and Allegheny rivers. Also the country between Philadelphia and the Susquehanna was to be explored.

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* "They are sensible that the period has arrived when Pennsylvania is called upon by every consideration of interest, duty, and honor, to bring into active exertion those financial and geographical means with which she is endowed by a bountiful Creator.

On the north side of Pennsylvania, before the lapse of many months, New York will have united by a canal of more than 400 miles in length the Hudson River with Lakes Champlain and Erie. On the south side of the state, Maryland and Virginia have projected a noble scheme of uniting the Potowmac with the Ohio. These improvements, so honorable to the enterprise of the respective states, and so useful to our common country, as permanent sources of national riches and aggrandisement, should excite a spirit of emulation, and induce Pennsylvania to create improvements of a similar character, and endeavor to fix within her own limits, and direct to her own seaport, at least a portion of that trade and wealth which awaits the enterprise of those states who establish easy and cheap communications with the vast populations rising in the West. . . . Noiseless and modest she may continue to move, but unless she awakes to a true sense of her situation, and ascends to times and circumstances, she will be deprived of the sources of public prosperity, her career of wealth will be less progressive than that of other states, and instead of regaining the high commercial rank she once held, she will be driven even from her present station in the system of the Confederacy."—From Report of Committee, in J. H. Rep., 1823-24, p. 164.

† At the third reading in the legislature the vote stood 53 yeas, 34 nays.—J. H. Rep., 1823-24, p. 915.

‡ J. H. Rep., 1823-24, p. 1101.

The appointments* were made within four days of the passage of the act. Since a report, containing all the necessary information concerning the above routes, was required to be made to the governor of the state before the next session of the legislature, the task laid out for the commissioners was no mean one. Examination and surveys were immediately commenced, and on February 2d, 1825, the report† was ready. It bears evidence of extensive work. Much difficulty was experienced in securing the services of a competent engineer, and the work had to be commenced without one. Their labors convinced the commissioners of the "perfect practicability of making a canal" throughout the whole distance from Philadelphia to Pittsburg. The route recommended comprised four sections, as follows:—

1. From Philadelphia to the Susquehanna, a few miles above Harrisburg.

2. From the east bank of the Susquehanna to the upper forks of the Frankstown branch of the Juniata near Hollidaysburg.

3. From this point over the Allegheny mountain, by a tunnel four miles long, to the forks of the little Conemaugh river.

4. From this point to Pittsburg.

The arguments brought forward in favor of the improvement were very much the same as those already mentioned.‡ In spite of the efforts of Philadelphia's enterprising neighbors, it was confidently asserted that with a canal to the West, she would become the metropolis of the Union. Moreover, both the impetus it would give to the economic development of the state, and its financial success, were urged. The computed cost of the three sections from

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* The commissioners appointed were Jacob Holgate, of the city of Philadelphia; James Clarke, of Westmoreland county; and Charles Trezivulney, of Centre county, all supporters of the political party in power. See J. H. Rep., 1824-25, II, pp. 285-87, and Harrisburg Chronicle of April 12th, 1824.

† Full text of report in J. H. Rep., 1824-25, II, 239-285.

‡ The report was signed by only two of the commissioners. The reasons for Mr. Trezivulney not signing it were set forth by him in a letter to Governor Shultze, on February 9th, 1825, and published in the Journal of the House of Representatives, 1824-25, II, page 287. Mr. Trezivulney made a report, however, to the legislature in the same manner as the other commissioners. His report differed from those associated with him mainly with regard to passing judgment upon the most suitable route for connecting the eastern and western waters without an examination of all the routes.

Middletown to Pittsburg, built with American locks,* was $3,000,000. Money could be borrowed at 4½ per cent., and the canal completed in six years. It was predicted that the tolls would "support the government and educate every child in the commonwealth." No immediate action was taken by the government to execute the work proposed. However, the report of the committee was the subject of a good deal of discussion both within the legislature and throughout the country, and it was not without effect in hastening the commencement of the Pennsylvania canal.

Enough has already been said to suggest that Philadelphia had much at stake in the struggle for the trade of the West. As a rival of New York and Baltimore, it was now a serious matter to her whether the flames of the popular movement were fanned or extinguished. It was well known by many of her citizens that the scheme was by no means popular in some parts of the state. Apprehensions of the expense involved and fear of failure made many public-spirited citizens hesitate to endorse a movement for commencing a canal to the West. Besides, its promoters had no concerted and well-formulated plans, and little opportunity to exchange opinions. Hence it was only natural to expect that some fruitful minds should devise a means by which the popular agitation might be directed, and by which thousands in the remote parts of the state might be educated in the matter of transportation improvements. This was furnished by the formation of "The Pennsylvania Society for the promotion of Internal Improvements in the Commonwealth."†

The preliminary meeting was held on November 26th, 1824, and on the 14th of the following month the formal organization took place and the constitution was adopted.‡ Its object was clearly

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* The European plan of building locks of cut stone, and counter arches of brick turned in the bottom, was very expensive. On the New York canals and the Union canal of Pennsylvania wooden foundations were used, and the commissioners recommended these for the proposed canal.

† This organization, when referred to later, will be called the Improvement Society.

‡ The full list of officers was: President, John Sergeant; Vice Presidents, John Connelly, Mathew Carey, and Paul Beck, Jr.; Treasurer, John White; Recording Secretary, John Y. Clarke; Corresponding Secretary, Gerard Ralston; Acting Committee, Mathew Carey, Joseph Memphill, Richard Peters, Jr., Stephen Duncan, and Thomas Biddle. The full text of the Constitution may be found in Pamphlets, No. 143, State Library of Pennsylvania.

indicated in its name. Forty-eight of the leading citizens of Philadelphia were the charter members, while the honorary list contained the names of some of the most active friends of internal improvements in the United States. Within a year a fund of $5,540 was accumulated by the members paying $100 each and by subscriptions from interested citizens and corporations.* The educational work was placed in the hands of an "Acting Committee." Broadly speaking, it was twofold,—first, to disseminate knowledge throughout the state regarding the present transportation situation and the urgent need of improvements; second, to collect information possessed by other states and foreign countries concerning transportation. The former was designed to strengthen the ranks of the progressive party until a united effort would force the legislature to action. The latter would put them in possession of the technical knowledge required for the work of construction as soon as it should be authorized.

Several movements were soon started to effect the first of these objects. To these attention will be given later. As a preliminary measure, however, a circular letter was sent to leading men in all parts of the state, outlining the plans and purposes of the society and inviting their co-operation. A variety of pamphlets on turnpike roads, canals and railroads was published and widely circulated. In these and similar efforts to mould public opinion, many of the city and country newspapers gave their support.

To attain the second object, the recent experience of New York in building the Erie canal was studied. In addition to this, William Strickland, an architect and engineer of Philadelphia, was employed at a liberal salary to make an investigation of European railroads and canals. He left Philadelphia in March, 1825, and returned the following December. Most of his time was spent in England and Scotland. He procured for the society a working

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* These were principally coal companies. See Carey, Brief View of the System of Internal Improvements of the State of Pennsylvania, p. 7.

"At a meeting of the 'Pennsylvania Society for the promotion of Internal Improvements in the Commonwealth' held at Heiskell's Hotel, February 25, 1825, . . . two letters were read, one from the Lehigh Coal Navigation Company, highly approbatory of the objects and efforts of the society, and tendering a donation of $200 as their contribution towards the effectuation of those objects—the other of similar import, with a donation of $100 from the Schuylkill Navigation Company."—United States Gazette, March 1st, 1825.

model of a locomotive engine of the best type then known, having a *two-man* power. His report,* which was soon published, contained a collection of useful information concerning the various purposes of his mission. He described conditions as he found them, and made numerous drawings of various parts of railways, canals, etc. He did not apply the information received to American conditions, nor did he recommend the adoption of either railways or canals in Pennsylvania. In all points of public policy he was entirely non-committal.

Meanwhile vigorous efforts were being put forth to spread the popular movement. At a meeting of the Improvement Society held in February, 1825, a committee was appointed† to prepare an address‡ to the citizens of the state concerning the urgent need of a direct line of communication to the West. Within a week it was ready and soon it was widely circulated.§ Its framers disclaimed at the outset any prejudice for or against any particular route. The same attitude was announced regarding the adoption of a railway or a canal. Not until accurate explorations and surveys had been made, and fuller information obtained by disinterested parties, could these questions be properly determined. Waiving these minor considerations for the time being, it was earnestly hoped that there would be a united effort on the part of all the people of the state to bring about a transportation line to the West. Three principal arguments were brought forward to justify the present appeal to the people—the financial benefit; the need of the proposed work to preserve the commercial life of Philadelphia; and the effect it

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* Reports on canals, railways, roads, etc., made to "The Pennsylvania Society for the Promotion of Internal Improvement," by William Strickland, Architect and Engineer. Philadelphia, 1826.

† The committee consisted of Messrs. Samuel Archer, Stephen Girard, Nicholas Biddle, John Connelly, Paul Beck, John Moss, E. S. Burd, Nathan Sellers, Samuel Wetherill, Thomas Leiper, John Sergeant, Nathaniel Chapman, Samuel D. Ingham, Thomas Cadwallader, and Mathew Carey.—United States Gazette, March 1st, 1825.

‡ A brief address had been published in the United States Gazette, etc., on January 25th, 1825. It occupied one column and was concerned mainly with showing the relative decline of Philadelphia's trade as compared with New York and Baltimore.

§ "An address to the Citizens of the Commonwealth of Pennsylvania by a Committee of the Pennsylvania Society for the Promotion of Internal Improvements in the Commonwealth." It was issued in the form of a pamphlet of ten pages. The newspapers of the state were requested to copy it.

would have upon the economic activity of the state. Let us briefly examine the case as presented.

The financial success of a trunk line to the West was assured. The tolls of the Erie canal had increased from $20,224 in 1821 to $340,642 in 1824. The yearly interest on the capital invested in the canal was $375,823; and even before its completion the tolls were almost equal to this sum. New York expected to liquidate the entire debt in ten years, and then the canal fund would defray all the expenses of government, and leave an annual surplus to extend internal improvements within the state. If this could be done, surely Pennsylvania, a richer state, and one better situated for controlling the trade of the West, had ensured to her, from the start, the ultimate success of a similar work.*

Philadelphia's peculiar interest in the proposed improvement was explained by the fact that the exertions of her neighbors on the north and on the south threatened her commercial extinction. The present efforts were calculated not merely to regain what was lost. The struggle was of a more serious nature. For without a more rapid and less expensive route than then existed, not even the trade with the western part of Pennsylvania could be retained.

To illustrate the general economic effect of internal improvements, the advantages England had derived from her canal system were outlined. Reference also was made to the stimulating effect of the Middlesex canal† upon the dormant energies of New Hampshire. A "more recent and still more impressive" instance was found in New York. Land contiguous to the Erie canal had risen in value from three to five dollars per acre. Towns were springing up along its banks in places where, a few years previously, there were no settlements at all. Small villages, within three or

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* "Though it may at first appear doubtful, we feel confident, that immense as are the benefits secured to New York by her Erie canal, the Pennsylvania canal (or railway as the case may be) to connect the settlements on the Allegheny with those on the Susquehanna, the Schuylkill, and the Delaware, will insure to this state more solid advantages."—Extract from the address.

† The company was incorporated in 1789, although the canal was not completed till 1808. It extended from Chelmsford on the Merrimac, two miles above Lowell, to one of the inlets of Charles river, in Charlestown. This canal, like the Boston and Lowell railroad, was designed to facilitate intercourse between the Merrimac valley, in New Hampshire, and Boston.—Tanner, Canals and Railroads of the United States, p. 43.

four years, had doubled their population and were now thriving towns.

The advantages that would accrue to all classes from improved transportation methods were carefully detailed. The farmer would find increased demand, brisker sales and higher prices for his produce; the merchant, a wider field for his business; the manufacturer and mechanic, more certain employment and better pay for their industry; the capitalist, a better interest on his money; and the owner of lands and houses, a rise in rents of 25 or 30 per cent. Since every class participated in general prosperity, and suffered in general depression, the movement for internal improvements deserved the support of all.

While the attention of the public was being directed repeatedly to the subject of transportation, the Improvement Society was occupied in promoting another movement. Its purpose was to impress the legislature with the strength of the popular movement. At the suggestion of the society, a public convention* of the citizens of the city and county of Philadelphia was held in the county court house on January 24th, 1825.† The attendance was large and the whole subject of internal improvements was discussed at length.‡

A resolution was passed to the effect that a "water communication ought to be opened with all practical expedition between the Susquehanna and Allegheny rivers, and between the Allegheny river and Lake Erie, at such points as the wisdom of a suitable board of skilful and experienced engineers may select"; also that the work ought to be built and paid for by the state. A committee of twenty-four§ was appointed to prepare a memorial to the legislature embodying the opinions of the convention. The "Acting

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* A full account of the proceedings of this convention is given in the United States Gazette, January 28th, 1825.

† The meeting adjourned after some preliminary discussion and reassembled three days later.

‡ Chief Justice William Tilghman was president of the meeting, and Nicholas Biddle, President of the United States Bank, was secretary.

§ The following gentlemen composed the committee:—Chief Justice Tilghman, Judge Duncan, John Sergeant, N. Biddle, M. Carey, R. Peters, Jr., C. J. Ingersoll, W. T. Duane, J. Randall, B. Chew, Jr., Manuel Eyre, Samuel Wetherill, C. Evans, Samuel Archer, Daniel W. Coxe, Thomas Biddle, Paul Beck, Jr., George Vaux, Charles Penrose, I. W. Morris, Samuel Mifflin, James Ronaldson, Daniel Groves and John Nagle. This committee contained a number of members of the Improvement Society.

Committee" of the Improvement Society rendered valuable assistance in this matter.

The memorial* was duly prepared and the organization for its extensive circulation was carried out even to the minutest details. Ward and district committees in every county in the state were engaged to secure signatures. An examination of the county newspapers of this date shows that the memorial aroused much interest. Public meetings were held in the halls or schoolhouses in many communities to discuss the various phases of the question at issue. It took but a few days to complete the canvass in some districts, while in others the matter required more time. By the middle of February, the memorials began to be presented to the legislature, and, for some weeks afterwards, they continued to pour in.† Their effect was reflected in a bill‡ reported in the senate on the last day of February, 1825, entitled, "An Act to appoint a Board of Canal Commissioners." It passed the third reading on the eighth of the following month and the next day the clerk of the senate presented it to the legislature for concurrence. With various changes and amendments it passed the third reading in the house on April 6th by a vote of 63 to 15. A compromise on the points of difference was easily adjusted and on April 11th it was duly approved§ by Governor Shultze.

This act repealed the one of March 27th, 1824, and now empowered the governor to appoint five canal commissioners. Their duty was to take all necessary steps in preparation for "the establishment of a navigable communication between the eastern and western waters of the state, and Lake Erie." The board was to choose one of their number for a president. Also the appointment of a suitable secretary with an adequate remuneration rested in their hands.

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* For the full text of this memorial see Appendix I, p. 261.

† See J. H. Rep., 1824-25, Vol. 1. The following pages contain notices of petitions, as above, being presented: 341, 344, 352, 358, 359, 364, 371 (eight different ones, February 16th, 1825), 376. 384 (five, February 18th, 1825), 391, 392 (ten, February 19th, 1825), 397 (fourteen, February 21st, 1825), 401, 416, 417, 424, 430, 435, 443, 454, 461, 467, 477, 482, 493, 499, 500, 507, 515, 518, 523, 529, 536, 547, 557, 574, 586, 598, 619, 686, 716, 741 (April 7th, 1825). See also Senate Journal, 1824-25.

‡ Senate Journal, 1824-25, p. 519.

§ J. H. Rep., 1824-25, I, p. 816. Full text of act in Pamphlet Laws, 1824. 25, p. 238.

No compensation was to be allowed for their services, but they were to be reimbursed for all reasonable expenses incurred in the execution of their duties. Power was given to them to employ, at reasonable salaries, engineers, surveyors and draftsmen to assist in making examination and surveys. After this work had been done, the commissioners were instructed to make detailed estimates of the sum of money necessary to complete the canals, feeders, and reservoirs, according to the plan they should recommend. They were also directed to inquire how a canal fund to build the works could best be created; to ascertain the terms upon which loans could be obtained; and to devise means for providing for the payment of the interest, and for the ultimate liquidation of the principal.

Before the end of April Governor Shultze had appointed as members of the canal board, Dr. Robert M. Patterson and John Sergeant of Philadelphia, Dr. William Darlington of Chester county, David Scott of Luzerne county and Albert Gallatin of Fayette county.* The latter, however, declined the appointment and his place was taken by General Abner Laycock. In consequence of the delay thus incurred, the board was not formally organized until July 4th, when John Sergeant was elected president and Joseph McIlwaine secretary, and the notes, papers, etc., of the late commissioners were handed over to the new board. Vigorous efforts were at once undertaken to carry into execution the tasks set for them. William Wilson was selected as chief engineer, and at a meeting held on October 26th, reports were made by him and also by John Mitchell on surveys made during the preceding months. In December, closely following his arrival from England, William Strickland was retained as consulting engineer, and engaged to prepare maps and estimates of the several routes already surveyed.

By the appointment of a board of canal commissioners, the aims of the numerous friends of internal improvements had been only partly realized. Some more impressive influence than numerous petitions must be brought to bear upon the government urging it to provide for the immediate commencement of the canal. This was provided for in the movement which culminated in the Harrisburg convention held from August 4th to 6th, 1825.

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* Niles' Reg., XXVIII (April 30th, 1825), p. 144. This journal in remarking upon the appointment pronounced it "an admirable selection."

At a public meeting of the citizens of the city and county of Philadelphia on May 3d, called by the committee of twenty-four, the preliminary arrangements were made for this gathering. The "Acting Committee" of the Improvement Society was directed to second the movement. A large number of influential citizens was present and after a good deal of discussion it was decided to call a convention at Harrisburg, on August 4th, to discuss the whole subject of internal improvements.* It was believed that if delegates from all quarters of the state could thus be assembled, and if a majority of them endorsed the popular movement for a canal to the West, the government then would have no reason to further delay the commencement of the work. Six delegates from the city and seven from the county of Philadelphia were appointed.† The duties of the committee of twenty-four were renewed, and arrangements were made for a systematic canvass so that every part of the state should be represented. Within two weeks several counties had appointed‡ or were preparing to appoint delegates. From this time on the county newspapers contained reports of numerous meetings held for the discussion of transportation improvements, and to consider the advisability of sending representatives to the proposed convention.

It is not to be understood that there was no opposition—far from it. Even in the town meeting held at Philadelphia, serious objections§ were raised to the resolution to call a convention. It was urged that such a gathering might retard the movement for putting through at once the main line of works; that it might excite angry feelings; or that discord in the *convention* might produce hostility in the *legislature*. As would naturally be expected, the arguments used in other parts of the state were of a different

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* A full account of the proceedings of the meeting is given in the United States Gazette of May 10th, 1825.

† *For the City.*	*For the County.*
J. Sergeant.	J. Holgate,
W. T. Duane,	Daniel Groves,
M. Carey,	Alex. McCaraher,
W. Lehman,	Geo. W. Riter,
M. Eyre,	Samuel Breck,
C. T. Ingersoll.	James Ronaldson,
	Samuel Humphreys.

‡ United States Gazette, May 24th, 1825.

§ See United States Gazette, May 24th, 1825.

character. The Miners' Journal* of Pottsville, Schuylkill county, was perhaps the most pronounced and bitter in its criticisms. It was urged that a portion of the state would be injured by the improvements that were in contemplation, and that superabundant advantages would accrue to Philadelphia at the expense of the country districts. These and other objections were due largely to sectional jealousies and local interests prevailing to a greater or less degree in various parts of the state. Among the criticisms offered at this time, however, were some that proved to be nothing short of sound judgment. Moreover they showed, at least to unprejudiced minds, that there were really two sides to the canal project. The following article from the Erie Gazette, written when the popular movement was nearly at its height, is typical of a feeling shared by a conservative element in various parts of the state:—

"The advocates of a grand canal in this state have, in taking the New York canal as the basis of their calculations, entirely overlooked its peculiar advantages. The Clinton canal (it may with propriety be so named) traverses a country so level that the amount of its lockage does not much exceed the height of Lake Erie above tide water—passes at right angles to the course of numerous rivers that flow from the south, is consequently easily and abundantly supplied with water—possesses along its whole extent a fine wheat country—terminates in Lake Erie, and thus connects an immense inland navigation with the ocean at the city of New York, the commercial depot of America. A canal through Pennsylvania would have nothing in common with this, excepting its termination in Lake Erie. How far it might compete with others for the

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* "If the proposed improvement be made at the expense of the state, each and every county must and will bear their equal proportion of the expense, the benefit of which will be received entirely by the city and county of Philadelphia, and those counties through which the improvement will pass. Hence the counties removed from the line of communication will be paying for an improvement from which they will not only receive no benefit whatever, but by which they will be very materially injured, unless measures are taken to prevent it."

"All that the city cares for, is to get the proposed improvements made, and that at the expense of the State; when these are accomplished the counties may get what they can . . . The country has nothing to expect from the liberality of the city; the latter will get all they can and then be the first to oppose every measure calculated to promote the interests of the former."—See letter signed "Brindley" in the United States Gazette of June 3d, 1825, which contains quotations from the Miners' Journal. See also same paper for June 7th, 1825.

trade of that lake, may in some measure be estimated by the fact that before it could advance fifteen miles from the lake, it would require a lockage almost equal to the whole of that of the New York canal. The amount of the whole lockage required can only be known when surveys are completed, probably four to five times that of New York. The expense of constructing such a canal ought to be estimated, not from the average of the other, but the most expensive part of it. . . .

It is not intended by these observations to discourage the formation of canals where they may be of advantage. No objections occur to exploring and surveying the State with a view to improvements. Information will be gained, and if it is found to be impracticable or unadvisable to canal its whole extent, still it may be done partially with advantage and profit. Our State possesses many natural advantages—let us improve them. We will certainly fail to compete with the State of New York for the trade of the West. Nature has given her advantages in such a competition which we cannot overcome."*

In spite of opposition and objections that were urged against both the proposed canal and the convention, the movement proceeded apace. Whether on account of interest in promoting the cause or to check any effort made by the friends of the movement, delegates† were appointed by all the counties of the state except two. At ten o'clock Thursday morning, August 4th, they assembled in the hall‡ of the house of representatives at Harrisburg. A committee was appointed to frame a set of resolutions which would bring the matters for consideration properly before the meeting. The following day, when they reported in favor of the state building a canal to connect the Susquehanna with the Ohio and Lake Erie, a storm of opposition arose. It was confidently asserted that the measure was impracticable; that the movement was premature; that the canal would injure the turnpikes; that the resources of the state were inadequate for building the works; that it would require oppressive taxation to which the people would not submit;

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* This article, copied from the Erie Gazette, appeared in the Harrisburg Chronicle on March 10th, 1825.

† The United States Gazette of August 19th, 1825, in commenting upon this convention said: "The convention at Harrisburg for internal improvements was, whether in reference to the majority or minority, superior to any body of the same number which has assembled in this state for many years."

‡ Provision had been made for the meetings of the delegates to be held in this place, by Mr. Lehman, the representative for Philadelphia, submitting in the house a resolution to that effect on April 11th, which passed by a vote of 41 to 26.—See J. H. Rep., 1824-25, I, p. 791.

that Philadelphia was the prime mover in the agitation and that she would receive the greatest advantage from the improvements; that those parts of the state through which the canal passed would receive undue benefits at the common expense. Among those opposed* to the scheme were all the delegates from Bedford, Franklin, Cumberland, York, Lancaster, Northampton, Pike, Wayne, Bradford and Tioga counties.

The cause for this opposition is apparent. An examination of the accompanying map of Pennsylvania shows that the first five of these counties are situated in the southern part of the state. Their exports, consisting of grain, flour and other farm produce, were marketed principally in Baltimore and the neighboring counties of Maryland and Virginia. The turnpike through Lancaster gave a direct communication to Philadelphia satisfactory to the inhabitants of that county. The other district whose delegates unanimously opposed the resolutions was in the northeastern part of the state. These counties had no chance of sharing the benefits of the proposed improvements. Moreover, those on the northern border of the state carried on their limited trade with New York. With little or no chance of participating in the proposed canal to the West, except to help pay for it, it is no wonder that the representatives of the opposition states took the stand they did.

The friends of the movement were in the majority, however, and ably refuted the arguments of those attempting to block the passage of the resolutions. The whole case for the proposed improvements was presented in a way that could not fail to convince the doubtful. The discussion was prolonged until the third day; and, finally, after numerous amendments were proposed by the minority to no avail, the resolutions† as framed by the committee were adopted by a large majority.‡

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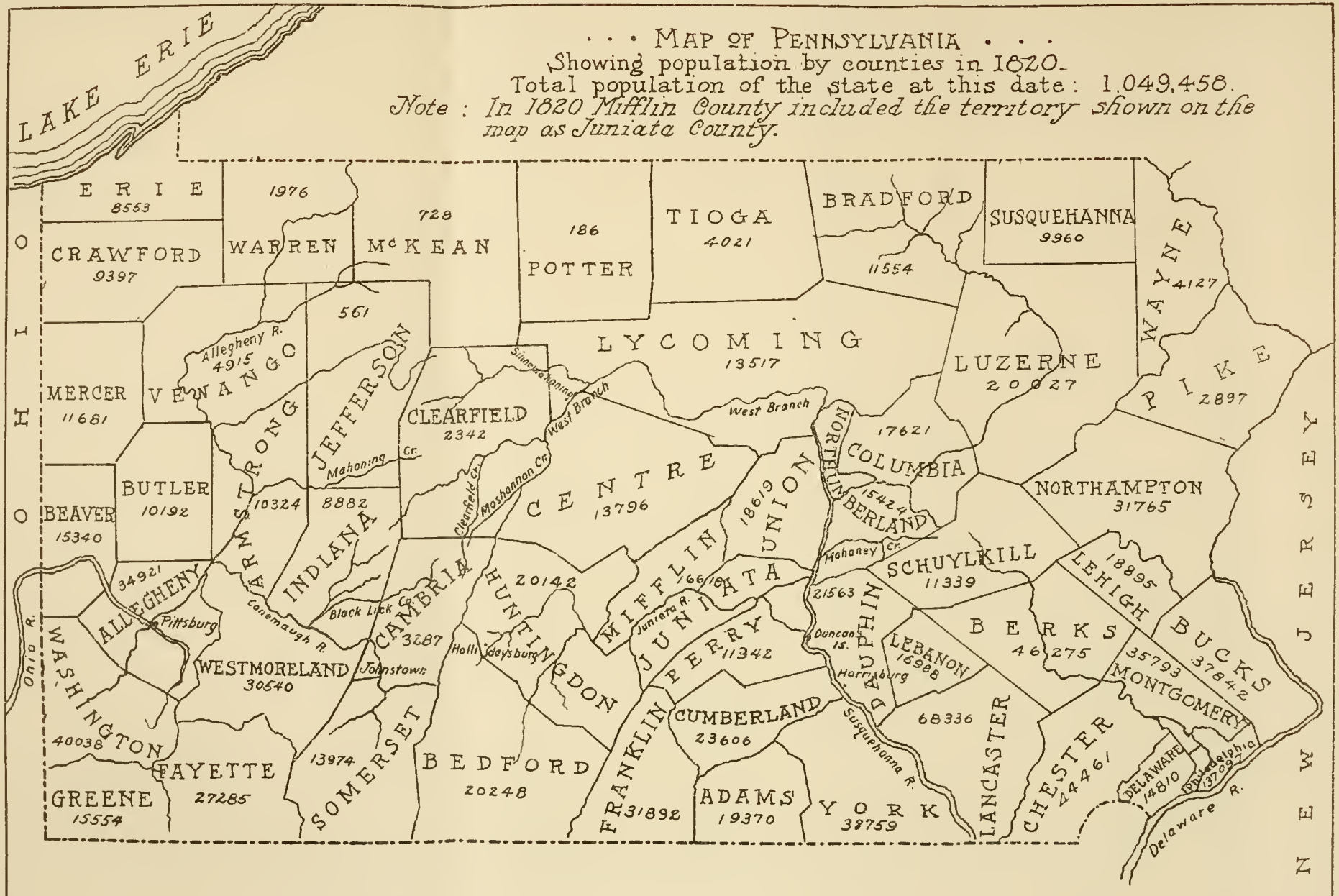
* A full list of the delegates from each county, showing the way they voted, is found in Appendix II, p. 264.

† For the full text of the resolutions see Appendix III, p. 266.

The words "within her borders" in the first resolution were struck out, however, since it was urged that they might be considered as aiming a blow at the proposed canal to connect the Potomac and the Ohio.—Niles' Reg., XXIX, p. 62.

Another unimportant resolution was added to those reported by the committee, for which see Niles' Reg., XXIX, p. 62.

‡ The vote on the first three resolutions was approximately 87 ayes and 26 nays. The references we have seen differ somewhat, being probably written from memory. The vote on the fourth resolution, which really had no bearing on the important objects of the convention, was 107 ayes and 6 nays.



. . . MAP OF PENNSYLVANIA . . .

Showing population by counties in 1820.

Total population of the state at this date: 1,049,458.

Note: In 1820 Mifflin County included the territory shown on the map as Juniata County.

The Harrisburg convention was a decided victory for the progressive party. It was now felt that the legislature had, in the proceedings of this body, the fullest evidence of the wishes of the people. To its action, the public mind was now directed with confidence and pleasing anticipation.

On the 6th of December the legislature convened. With reference to internal improvements, Governor Shultze's message* was conservative; but it was regarded as "susceptible of no misapprehension."† Referring to the much agitated canal, he stated:—"Desirable as it is to facilitate intercourse between all parts of our Commonwealth, and to do it speedily, still this desire will not induce the representatives of a prudent people to engage in such great enterprises without having before them all the information and the knowledge which are essential to entering upon and completing the work in the best, most durable, and most economical manner." No time was lost in bringing to the attention of the legislature the wishes of the populace. The day after the opening of the session a resolution‡ was introduced in the house looking towards the commencement of the long-desired canal. The manner was afterwards referred to from time to time. On the 16th of January, 1826, the "Committee on Inland Navigation and Internal Improvement" introduced a bill§ entitled, "An Act to Provide for the Commencement of a Canal, to be constructed at the Expense of the State, and to be styled, 'The Pennsylvania Canal.'" It passed the third reading on the 2d of February by a vote of 61 to 32‖. The bill passed the senate¶ on the 22d of the same month

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* See. J. H. Rep., 1825-26, II, No. 1.

† From Editorial in United States Gazette of December 13th, 1825.

‡ See J. H. Rep., 1825-26, I, p. 11.

§ See J. H. Rep., 1825-26, I, p. 192.

‖ See J. H. Rep., 1825-26, I, pp. 310-311. The vote shows that the opposition included all the members from those counties that voted "nay" at the Harrisburg convention, also the representatives of several counties between the Delaware and the Susquehanna, already provided with adequate means of transportation. All the members from Adams, Bedford, Cumberland, Franklin, Lancaster (with one exception), Lehigh, Lebanon, Northampton, Perry, Pike, Union, Wayne, and York counties voted against the bill. Berks, Montgomery, Schuylkill, Westmoreland, and Philadelphia counties were divided. Mr. Heston, one of the members for Philadelphia county, voted in the negative, in opposition to his colleagues, and to the sentiments of his constituency.—Carey, Brief View of the System of Internal Improvements of the State of Pennsylvania, p. xv.

¶ See Senate Journal, 1825, p. 363. The vote was nineteen ayes—fourteen nays.

with minor amendments, which were approved of by the house the following day; and two days later by the approval of the Governor, the commencement of the canal to connect the eastern and western waters was provided for by an Act of Assembly. The indomitable perseverance of the advocates of the scheme in Philadelphia and elsewhere had at last borne fruit.

The Act of February 25th provided for the commencement of the canal at both extremities simultaneously. The parts authorized to be put under contract at this time together constituted but a small fraction of the total length.* They were as follows:—From the western end of the Union canal to a point on the Susquehanna opposite the mouth of the Juniata; and from Pittsburg to the mouth of the Kiskeminetas. The combined length of these sections was fifty-four miles. Since they were common to all the routes proposed, it was considered safe to commence them before it was finally decided what line the canal should follow through the center of the state.

This view was the result of three reports recently made to the legislature. The recommendations made by the first board of commissioners appointed on March 27th, 1824, have already been examined. Two reports† made by the board of canal commissioners previous to the passage of the Act of February 25th, 1826, demonstrated equally well the practicability of building a canal to connect the eastern and western waters. But the question of route for all the sections, excepting limited portions at either end, was still somewhat in dispute. Accordingly, more accurate and detailed surveys were necessary to warrant the legislature in deciding upon the best location for the canal.

In view of the policy adopted later, it is important at this point to note that the popular movement was for but one improved line of transportation. The various reports of the canal commissioners, and of the committee on roads and inland navigation, show that their efforts had been directed to the problem of discovering which one of the three possible routes was preferable. Moreover, the Act

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* This act also provided for the construction of a navigable feeder of a canal from French creek to the summit level at Conneaut lake as soon as the canal commissioners should deem it expedient and practicable; also for the surveying and locating of a canal from Conneaut lake to Lake Erie.

† December 30th, 1825, and February 3rd, 1826,—found in J. H. Rep., 1825-26, II, pp. 159-163 and 222-233.

of February 25th made no reference to the building or even to the surveying of lateral lines. The title of the act (p. 185) shows that it was to provide for *a canal* to be called "The Pennsylvania Canal"; and further evidence is furnished by its preamble that public opinion called for the construction of a single work to connect the eastern and western waters. In a word, the whole movement for improvements in transportation facilities from the very beginning until legislation was secured authorizing the commencement of construction had been for a direct avenue of commerce to the West. That it should be pushed through at once with all consistent speed was the programme agitated; for in no other way might Philadelphia have a fair chance with New York and Baltimore in the struggle for the western trade. Lateral lines were mentioned as being necessary as feeders to the main canal; but all references to them indicated that the intention was to postpone their construction at least until the main line should be built.

In conclusion, a word is necessary as to why the state itself undertook to build the work rather than entrust its construction to a private company. It does not appear that the adoption of that policy was due to any fear of corporate power. On the contrary, the incorporation of companies to construct and operate works of public utility in many cases was considered necessary.* The creation in the past of numerous turnpike, bridge and navigation

* "The incorporation of companies to carry on works of great public utility, such as canals and turnpike roads, which necessarily require large associations to furnish the capital, which the finances of the state may not be in a situation to meet, have ever been found useful and efficient means of accomplishing these important public ends; and banking and insurance companies have also been classed with these objects which render corporate power necessary to conduct their operation with advantage to the public. But the incorporation of associations to carry on a business within the reach of individual capital, by conferring on them extraordinary privileges and exempting them from the ordinary personal liabilities, is not only inconsistent with the dictates of sound political economy, but at open war with the principles of a free government. This sound distinction in the incorporating of companies to accomplish works of great public utility, and those for the mere purpose of promoting objects within the sphere of individual enterprise, has happily been adopted and pursued by the legislature of this state with few exceptions, and the instances of departure from this wholesome discrimination, furnish the strongest evidence in favor of the wisdom of the general course of policy."—Report of Committee of the Senate of Pennsylvania, regarding corporations, read February 4th, 1825.

companies furnishes conclusive evidence on this point. Moreover, as we have already seen, the state from time to time had made liberal subscriptions to the stocks of these concerns. Having pursued a policy of assistance in the past, it was no radical change, at this time, for the energies of the government to be applied directly to matters of internal improvement.

But there seem to have been definite reasons why the work was constructed by the state itself. In the first place, the era of large corporations had not been reached by 1826, and there was not the large quantity of floating capital, such as exists nowadays, ready to be applied to the purchase of stocks. Moreover individual capital and energy were not considered commensurate with such an extensive enterprise as that proposed.* Again, even though sufficient private capital could have been commanded to build the canal, the advantages to be derived from it after its construction were regarded as too numerous and important to be surrendered to a corporation. It was believed that both the maximum of impartiality and the minimum of cost of operation would be insured by state control; and, since the canal was essentially a state object, these needed to be guaranteed to every one of its citizens. Moreover, the work was looked upon as a source of large income in the future. This point seems to have been hardly doubted by the majority. Hence the opportunity to fill the public treasury by such a legitimate source of income as canal tolls should be seized and not be forfeited to a few individuals. In view of the general acceptance of these ideas, throughout the whole popular movement the question as to who should build the contemplated improvement was discussed but incidentally, it being taken for granted that if the work were built at all, it should be executed and operated by the state.

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* "The public are now firmly convinced that, in the United States, where the fortunes of private individuals are limited in amount, great public works can only be accomplished by the expenditure of the public treasury."—Facts and arguments in favor of adopting Railways in preference to Canals in the State of Pennsylvania, p. 10.

Chapter III.—The Construction of the Public Works.

In response to their new duties detailed in the Act of February 25th, 1826, the canal commissioners* immediately prepared for the work of construction. On April 5th, Nathan S. Roberts, an efficient engineer formerly employed on the Erie canal, was sent to locate the line between Pittsburg and the Kiskeminetas river. The determination of the other section between the Swatara and the Juniata was entrusted to William Strickland, and on the 19th of June Governor Shultze approved his location. Accordingly, on July 4th, 1826, near the Capitol at Harrisburg, the ground was first broken† in the construction of the Pennsylvania canal.

In their reports of December 11th, 1826, and of February 6th, 1827, the commissioners stated that they had put under contract 22 ½ miles of work along the Susquehanna river, and 24 along the Allegheny. A large force of laborers‡ had been engaged for both sections, and construction was being pushed along rapidly. The surveys made during the preceding year had convinced the board

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* The first acting commissioners appointed in accordance with section 2 of the Act of February 25th, 1826, were General Abner Lacock and Charles Mowry for the eastern and western sections respectively.

By Act of April 10th, 1826, the board of canal commissioners was augmented by the appointment of four new members, making a total of nine, five of whom constituted a quorum. By Act of April 16th, 1829, the power to appoint them was transferred from the governor to the legislature. Their period of service was one year. By Act of April 6th, 1830, the number of the commissioners was reduced to three, and the governor was again authorized to appoint them. Another change was made in the canal board in 1841 by which each branch of the legislature appointed one member and the governor the third. The appointments to this office were largely political. See Niles' Reg., XXXVI, p. 268, and LIX, p. 359.

† J. H. Rep., 1834-5, III, p. 3.

‡ The writer made a careful examination of the reports of the canal commissioners covering the whole period of construction of the public works, to discover whether or not any delay was caused by a scarcity of laborers. The conclusion reached was that at no time was there any serious interruption of work due to this cause. The delays were most often due to the appropriations becoming exhausted, or to timber and other construction materials running out. The workmen were frequently discharged at these times, and made engagements elsewhere, so that when work was ready to be resumed it required some time to get laborers.—See J. H. Rep., 1827-28, II, pp. 99, 138 and 216; 1828-29, II, p. 68; 1829-30 II, p. 239; 1830-31, II, p. 222; 1833-34, III, pp. 16, 45, 46 and 63. Numerous references in Canal Commissioners' Report in J. H. Rep., 1831-32, II.

that of the three possible routes to the West, the one via the Juniata was, by far, the most practicable. In recommending its adoption the commissioners stated that a portage wagon road* over the mountain should connect the canal sections on either side.

Since the Act of February 25th provided for the construction of only two short sections of the canal, in order to avoid delay, it was now necessary that additional legislation should be passed. The most advantageous route having been determined by those best calculated to pass judgment thereon, there was no further need of deferring action. Accordingly, on the 9th of April, 1827, "An Act to provide for the further extension of the Pennsylvania canal"† received the governor's approval. It required the commissioners to locate and contract for making a canal along the valley of the Juniata from the Susquehanna to Lewistown; to build a canal, locks and other necessary works from the western section to Blairsville via the Kiskeminetas and Conemaugh; to commence work on the feeder from French Creek to Conneaut lake; to contract for all sections common to both of the proposed routes‡ between Pittsburg and Lake Erie; to build the works necessary for a canal navigation up the Susquehanna from the Juniata to Northumberland; and to expend not more than $100,000 for the construction of a canal along the Delaware river between Bristol and Easton.§ The same act of legislature required the commissioners to undertake at once numerous surveys extending to almost every stream of the commonwealth and to nearly every section of the state.

An analysis of the above shows that, of the six different parts of the improvement system whose commencement was now provided for, only two were on the main line.‖ These were along the Juniata

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* At this time the prevailing opinion was that the link between the canals on either side of the mountain should be a macadamized road.

† Laws of Pennsylvania, 1826-27, p. 192. See also J. H. Rep., 1830-31, II, pp. 600-601.

‡ These were, first, via the Allegheny river and French creek to Presque Isle; second, through the Ohio river to Beaver, thence by way of Beaver river and French creek to the same point on Lake Erie.

§ See sections 6 and 7 of the act on page 273.

‖ The main line when referred to later is not intended to include the sections of the public works between Pittsburg and Lake Erie. These were never completed by the state, and once the work of construction had been undertaken, contemporary writers rarely spoke of them as being a part of the main line.

and the Kiskeminetas. Moreover, of the surveys authorized,* those for determining the remainder of the Juniata route were only a small fraction of the elaborate list. A general extension of the

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* Surveys were required to be made from Frankstown on the Juniata, to Johnstown on the Conemaugh, across the Allegheny mountain, such as might enable them to determine in what manner and by what kind of works, whether by a smooth and permanent road of easy gradation, or by a railroad with locomotive or stationary engines, or otherwise, the portage or space between the above mentioned points might be passed so as to ensure the greatest public advantage. The board was also to cause further examinations, surveys, and levels to ascertain the practicability and cost of a navigable communication between the west branch of the Susquehanna and the Allegheny rivers; also a similar examination on the route from Northumberland up the north branch of the Susquehanna to the state line; from the western section of the Pennsylvania canal near the mouth of the Kiskeminetas to a point on Lake Erie, via the Allegheny river and French creek, at or near the borough of Erie; and from the city of Pittsburg to the said point on Lake Erie, by the route of Beaver and Shenango; also an examination, survey, and estimate of the route for a canal and also for a railway with locomotive or stationary engines from Philadelphia, through Chester and Lancaster counties, so as to connect by the nearest and most practicable route with the eastern section of the Pennsylvania canal; also surveys, examinations, and estimates for a canal down the Brandywine river to a point north of the Delaware state line, thence across the dividing ridge between that river and Chester creek, thence down the same to the river Delaware. The commissioners were also required to make an examination to ascertain the practicability and cost of forming a connection of the north branch of the Susquehanna and the river Lehigh by means of a canal or railway, also surveys and estimates from the termination of the Pennsylvania canal at the mouth of the Swatara down the east and west sides of the Susquehanna to the Maryland line, and to make report to the next legislature of the expense and practicability of extending the Pennsylvania canal to the intersection of the Maryland line and the said river. Examinations were also to be made from the mouth of French creek, by way of Waterford, to the bay of Presque Isle, and from Conneaut lake to Lake Erie; also examinations along the valley of the Delaware from Philadelphia, or from Bristol or any intermediate point between Bristol and the head of tide water to Carpenter's point, to effect a navigable canal communication; also surveys and estimates through the valleys of the Conodogwinet, Yellow Breeches, and Conococheague creeks, for the connection of the rivers Susquehanna and Potomac by a canal; also from the west end of the Harrisburg bridge to Chambersburg, and from the west end of the Columbia bridge through York and Gettysburg to Chambersburg; also the proposed route for a canal between the Schuylkill and the Delaware.—See sections 1, 3 and 11 of the act in Appendix V.

public improvements was thus foreshadowed. We have already seen, however, that the original plan was to build the main line first. If lateral branches were to supplement it, they were, at least for the time being, minor considerations. But now, scarcely more than a year after this scheme had been launched, it was supplemented by another which, when developed, provided the state with an extensive and unconnected system of transportation.* Hence it is clear that the Act of April 9th marks the commencement of a complete change of policy; and later developments showed plainly that the course to which the state was then committed was consistently pursued until 1834, when the main line and most of the lateral works were completed. Let us now see how the work of construction progressed under the new policy.

The first report of the canal board† after the passage of the Act of April 9th, 1827, was made the following December. It showed that during the year they had placed under contract 18 miles of canal on the Delaware division from Bristol upwards; 40 miles on the Susquehanna between the Juniata and Northumberland; 9 miles of the French Creek feeder; 44½ miles along the Juniata between its mouth and Lewistown; and 51 miles between Blairsville and Pittsburg. This made a total of 162½ miles of canal contracted for in 1827. Of this, 95½ miles were on the main line, leaving a balance of 67 miles for local works. Numerous surveys had been made although the most strenuous efforts had failed of accomplishing all of this work required by the Act of April 9th.

In March of the following year another act of legislature‡ was passed relative to the extension of the public improvements. It authorized the construction of not more than 45 miles of canal along each of the following rivers—the Delaware, Conemaugh, Juniata and the north branch of the Susquehanna. Along the west branch of the last-mentioned waterway, 25 miles of canal were provided for, as also 10 miles along its course between Middletown and Columbia. Recent surveys had convinced the canal board that

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* "I have been thus particular in referring to the several works directed to be put under contract by the Act of 1827, because it was the commencement of a scheme of diffusive and unconnected works of improvement."—Extract from Gov. Wolf's message, December 7th, 1831, in J. H. Rep., 1831-2, II, p. 17.

† See J. H. Rep., 1827-28, II, p. 93, and 1831-32, p. 132.

‡ Act of March 24th, 1828, in Laws of Pennsylvania, 1827-28, p. 221.

the topography of the country between Philadelphia and the eastern section of the Pennsylvania canal was better adapted to railroad than to canal construction. In accordance with this suggestion, the legislature now provided for the commencement of a railroad between Philadelphia and Columbia. By the same act, many local surveys omitted from the elaborate list of the previous year were now required to be made.

The report of the commissioners for 1828* furnished a good illustration of the working out of the new policy. Contracts had been let for 40½ miles of the roadbed of the Philadelphia and Columbia railroad, and for 195½ miles of canal. The following is a classified statement† of the latter:—

23 miles along the west branch of the Susquehanna.
45 miles along the north branch of the Susquehanna.
35½ miles along the Delaware.
10½ miles of the French Creek feeder.
26½ miles from Blairsville up the Conemaugh.
45 miles along the Juniata.
10 miles between Middletown and Columbia.

195½ miles in all.

By referring to the map (p. 196) it is seen that only the last three items refer to contracts along the trunk line. They represent a total of but 81½ miles, against 114 for purely lateral works.

On the 22d of April, 1829, "An Act relative to the Pennsylvania canal and railroad"‡ was passed. It gave the canal board the power to enter into contracts for those sections of the improvements along the Delaware and the north branch division not yet commenced. They were also directed to complete during the ensuing year, if possible, all the works then in progress. The following December they were able to report§ that 195 miles of canal were finished. Only 15½ miles of new work had been arranged for, but all of it was for extending local lines. During this year, rates of tolls were established and a code of rules to govern the operation of the public works was drawn up and adopted. The first revenue was collected in 1830 upon portions of the trunk line near Pittsburg and Middletown.

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* J. H. Rep., 1828-9, II, p. 67, and 1831-2, II, p. 133.

† J. H. Rep., 1831-2, II, p. 133.

‡ Laws of Pennsylvania, 1829, p. 251.

§ J. H. Rep., 1829-30, II, p. 225.

Although the work of construction had now been in progress for more than three years, and although many surveys had been made previous to the commencement of operations, yet neither the route nor the method of crossing the Allegheny mountain had been definitely determined. The dissipation of the energies of the state upon so many works caused serious delay in the settlement of these problems. By 1830, however, the negligence of the canal board in this respect was the subject of a good deal of discussion both within and without the legislature. It was urged that all other parts of the trunk line were now nearing completion. Until the links of canal on either side of the mountain were joined, however, the maximum advantage could not be obtained. For, as yet, they could be used only for local traffic, whereas the chief purpose in constructing the works was to provide a through route to command western trade. Accordingly, on the 27th of March, 1830, legislative provisions* were made for a thorough survey of the passes of the mountain by three competent engineers.

When the commissioners sent in their report† in December, 1830, their recommendation, based upon the recent surveys, was for a railroad rather than for a macadamized road to make the necessary connection. This matter was finally arranged for by an Act‡ of March 21st, 1831,—over five years after the first work on the main line had been authorized. Sylvester Welch, one of the most competent engineers in the service of the state, was given full charge, and under his direction the route was determined, and the road finally constructed.

In their report§ of December 15th, 1831, it appeared that, during the year, the commissioners had arranged for the construction of 155¾ miles of canal and feeder. An analysis of the "lettings" reveals the significant fact that only 50¼ miles were on the main line. The remainder, 105½ miles, or more than two-thirds of the total length contracted for, represented extensions of lateral works. In the meantime, arrangements had been made for the formation of the road-bed of a part of both the Allegheny portage and the Phila-

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* Laws of Pennsylvania, 1829-30, p. 129.

† J. H. Rep., 1830-31, II, p. 139. This report showed that water had been admitted into 406 miles of canal. Also 40½ miles of the bed of the Philadelphia and Columbia railroad were graded and ready for the rails.

‡ Laws of Pennsylvania, 1830-31, p. 194.

§ J. H. Rep., 1831-32, II, p. 107, and 1833-34, III, pp. 4-5.

delphia and Columbia railroads, also for laying the rails along about 40 miles of the latter line.

During the next two years 75 miles of new canal and railroad work were commenced. All of the canal work was on local lines. The railroad contracts were necessarily connected with the trunk line. Vigorous efforts were made to complete all the improvements in progress; and, when the canal commissioners made their report in December, 1834, they proudly announced that all the lines of canal and railway authorized by law were so far completed as to admit of transportation throughout their whole length.* The main line between Philadelphia and Pittsburg, though hampered in its construction by the dissipation of the energies of the state upon so many lateral and local works, had been completed in March, 1834. On account of the lack of facilities for handling traffic, very little business was done, however, until the following spring.

The total length of the through line was 394.54 miles. When it was ready for use, the state had undertaken and completed 637 miles of public improvements.

But the work did not end here. The faith of the state had already been pledged to several of its districts as yet not provided with their quota of improvements. Within two years, a renewed expansion of the system began. Liberal appropriations were made from time to time for the extension† of the north and west branch divisions along the Susquehanna, the line between Pittsburg and Erie, the Wiconisco canal, and the Gettysburg railroad. The new movement continued with occasional interruptions until 1842. During this time, 135 miles of work were completed and 162 more undertaken. This made the total length of the public improvements 934 miles. After 1842, the only important activity of the state in the matter of transportation improvements was directed to the furtherance of the north branch extension, and to avoiding the inclined planes on the railways of the main line.‡

In order to form any correct estimate of the location and extent of the state works, it is necessary at this point to consider the several divisions separately. Turning our attention to the trunk line,

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* J. H. Rep., 1834-35, II (Appendix), p. 3.

† J. H. Rep., 1840, II, p. 8.

‡ J. H. Rep., 1842, III, p. 4.

let us begin at its eastern terminus and examine the various sections in order.*

The Philadelphia and Columbia railroad was the first link in the western chain. It commenced at the intersection of Vine and Broad streets, Philadelphia, and terminated at Columbia on the Susquehanna, a distance of 81.6 miles, opening a direct communication between the valleys of the Delaware and the Susquehanna, and intersecting those of the Schuylkill, Brandywine and Conestoga.

As originally built, the road had two inclined planes. At a distance of about two miles from its point of commencement it crossed the Schuylkill by a viaduct 984 feet in length, and immediately ascended an inclined plane of 2,805 feet in length and 187 in height. Another inclined plane 1,800 feet in length and 90 in height was descended immediately before joining the canal basin at Columbia. The planes were never satisfactory, being slow and expensive in their operation,† and they were scarcely finished before efforts were made to avoid them. On the 30th of November, 1836, a contract was entered into for the construction of a road six and one-half miles long to avoid the one at Columbia. At its completion in March, 1840, the plane was abandoned. One track of the Schuylkill plane was avoided in October, 1850, and the other the following December, by the construction of the West Philadelphia railroad from a point near the present Ardmore station to the west end of the Market Street bridge. Various lateral extensions of this road were made, the two most important of which were those to York and Gettysburg. The legislature authorized the construction of this section of the main line of works on the 24th of March, 1828, and in March, 1834, a single track along the entire route from

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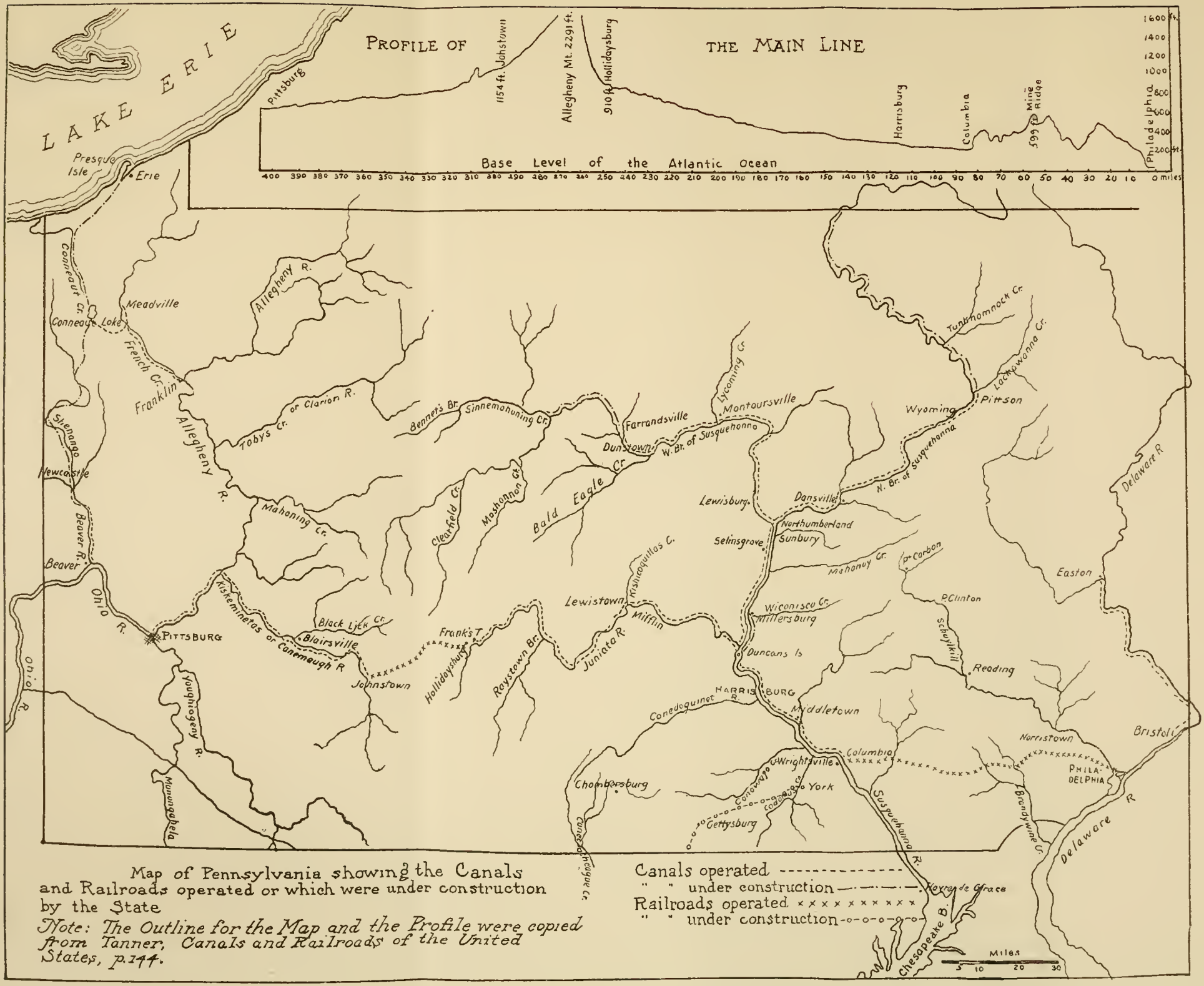
* Most of the facts found in the following description of the public improvements were taken directly from the reports of the canal commissioners, and from Tanner's Canals and Railways of the United States.

† They were operated by stationary engines located at the head of the planes. When open for use the prevailing opinion regarding its method of operation was that the farmers and other citizens along the line should use the railroad the same as they used the turnpikes, i. e., purchase suitable wagons to be hauled by animal power and pay a certain toll to the state for the use of the roadway. This method of operation was put into practice for a time. The demonstration of the practicability of steam-engines for motive power resulted in the adoption of locomotive engines in a short time. The state supplied the motive power for the transportation of goods and passengers, while the cars were owned by individuals or companies.



Map of Pennsylvania showing the Canals and Railroads operated or which were under construction by the State

Note: The Outline for the Map and the Profile were copied from Tanner, Canals and Railroads of the United States, p. 144.

Canals operated ----------

" " under construction —·—·—·—

Railroads operated ×××××××××

" " under construction -o-o-o-o-o-

Philadelphia to Columbia* was opened for travel. In October of the same year, the second track was completed and the road opened for public use.

The *Eastern* and *Juniata divisions* of the Pennsylvania canal extended from Columbia to Hollidaysburg, at the base of the Allegheny mountains, a distance of 172 miles. From the western terminus of the Philadelphia and Columbia railroad, the canal followed the east bank of the Susquehanna, passed through the villages of Maytown, Bainbridge, and Falmouth, and intersected the Union canal at Middletown. After uniting with the Susquehanna at this point by a series of locks, it continued along the east bank of that river, through Highspiretown and Harrisburg to Duncan's Island, where it was intersected by the Susquehanna and entered the valley of the Juniata river. It then followed along its north or left bank, and passing Millerstown, Mexico, Mifflintown, Lewistown and Huntingdon, terminated at Hollidaysburg. Here it met the Portage railroad across the Allegheny mountains. At the mouth of the Raystown branch of the Juniata was the Raystown feeder, one mile in length. Nearly 16 miles of these divisions consisted of slack water navigation.

The *Allegheny Portage railroad*† commenced at the termination of the Juniata division at Hollidaysburg and, pursuing a northwesterly course to Blair's Gap summit,‡ descended the valley of the mountain branch of the Conemaugh to Johnstown. There it joined the western division of the canal. The rise from Hollidaysburg to the summit was 1,398.71 feet in a distance of 10.1 miles.

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* The Susquehanna or "Tide water canal" extended from Wrightsville, opposite Columbia, to Havre de Grace in Maryland, thus affording an additional outlet to the main line of the state works. It was a private enterprise.

† The report of the commissioners who made the original survey for the canal connecting the eastern and western water proposed a continuous water route, by continuing the canals by means of numerous locks and dams as far as possible on both sides of the mountain, then piercing it by a tunnel rather less than four miles in length.

‡ This point is almost due east from Pittsburg. The cut made to reduce the summit was only about twelve feet, the natural summit being rather flat and wet. As ascertained by later railroad surveys, it was 2,322 feet above mean tide, or 161 feet higher than Gallitzen station on the Pennsylvania railroad.—Roberts, Reminiscences of the First Railroad over the Allegheny mountains, in Pennsylvania Hist. Mag., II, p. 386.

From there to Johnstown, the fall was 1,171.58 feet in a distance of 26.59 miles.* The principal part of the elevation was overcome by ten straight inclined planes, operated by stationary engines. There were five of them on either side of the mountain with a total length of about 4½ miles. Their angles of inclination ranged from four degrees and nine minutes to five degrees and fifty-one minutes. A tunnel at the Staple Bend of the Conemaugh, 4 miles east of Johnstown, attracted great attention. It was 901 feet long, 20 feet wide, and 19 feet high within the arch. It was the first tunnel built in America.† The first track was ready for use in 1834, although it was then in a very imperfect condition. It was not until late in the spring of the following year that the second track was completed. At first the state furnished the motive power only on the inclined planes and the road was used as a public highway. The dissatisfaction accompanying this method of operation soon resulted in the state also furnishing locomotive power on the grade lines between the planes.

As on the Philadelphia and Columbia railroad, the operating of the planes on the first portage line was not satisfactory, neither were they considered safe. Consequently suggestions for avoiding them were made immediately after the opening of the road. It was not until the construction of the Pennsylvania system began in 1847, however, that the state authorities gave serious attention to this matter. After encountering many difficulties, and the expenditure of several times the amount of money estimated as necessary for building it, a new Portage railroad was completed on July 1st, 1855. Although in an imperfect condition, it was then put into operation, and the old line, though somewhat shorter than the new one, ceased to be used.

The *Western division* of the Pennsylvania canal extended from Johnstown to Pittsburg, a distance of 104 miles, traversing the valleys of the Conemaugh, Kiskeminetas, and Allegheny rivers. After leaving Johnstown it passed the towns of Fairfield, Lockport, Blairsville and Warren, crossed the Allegheny above the mouth of the Kiskeminetas, and followed it for some distance. Again recrossing that river, the canal entered and passed through the city

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* Tanner, Canals and Railroads of the United States, p. 126.

† Wilson, The Allegheny Portage Railroad, in Annual Report of Secretary of Internal Affairs, Part IV, 1898-99, p. lxiii. This is doubtless the best and fullest history of the Portage road ever written.

of Pittsburg and terminated at the Monongahela river. In connection with this division two feeders may be mentioned; the Johnstown feeder, at the eastern terminus, having a length of one and one-half miles, and the Allegheny feeder from Alleghenytown to the western division, three-quarters of a mile long.

The entire distance between Philadelphia and Pittsburg by the main line was, it will be recalled, 394.54 miles. The canals were four feet deep, twenty-eight feet wide at the bottom, and forty at the water line. The locks were ninety feet long and from fifteen to seventeen feet wide.

A summary of the lateral works undertaken by the state is next in order.

The *Susquehanna division,* thirty-nine miles in length, commenced at the outlet lock on Duncan's Island, where it joined the eastern division of the Pennsylvania canal, crossed the northern outlet of the Juniata, and entered Buffalo township, in Perry county. It then pursued a course almost due north, along the right bank of the Susquehanna to the town of Northumberland. Here it intersected the canals that extended along the north and west branches of that river.

The *West Branch division* connected with the above canal at Northumberland, and passed along the left bank of the west branch of the Susquehanna, through Northumberland and Lycoming counties to Farrandsville creek. Its length, including several sections of pool navigation, was 72 miles. An extension of this division to the mouth of the Sinnemahoning creek, a distance of about 33 miles, was undertaken and abandoned in 1841.

The *Bald Eagle* side cut extended from the pool at Dunnstown dam, on the above division, to Bald Eagle creek, a distance of 3.62 miles.

The *Lewisburg* side cut extended from Lewisburg in Union county to the West Branch division, a distance of slightly more than half a mile.

The *North Branch division* commenced at the basin which united the Susquehanna and the West Branch division at Northumberland. This canal pursued a northeasterly course through the towns of Danville, Bloomsburg and Berwick and terminated at Lackawanna creek, a distance of 72½ miles.

In connection with this division was the *North Branch Extension,* upon which a large amount of money was expended, although it was

the direct interests of their constituency.* The following extract from a contemporary writer,† who observed the change of policy we have spoken of, sheds light upon the situation:—

"When provision was to be made for the further extension of the canal from the mouths of the Juniata and the Kiskeminetas, the Juniata route being found the shortest and most eligible, public attention was directed to it. To establish this route and provide for its execution was the great object for which the friends of internal improvement in the east and west had to contend. Those who were opposed to the entire project as premature, hazardous, extravagant, and partial, conceived that to successfully resist the adoption of this most popular route was the defeat or the delay of the whole, and, accordingly, directed their united force to oppose the passage of a law in favor of the Juniata route. The strength of the opposition, with the aid of those dissatisfied on the other explored routes, presented a vote that could not be overcome by the friends of the Juniata route. To break and divide the vote of the opposition became the object of the friends of a canal, and it would seem that at once the legislative hall became a market-place, wherein canals were to be bartered for a few years. A few members were to be conciliated and brought into the measure by appropriations to their district of country, and by such management or 'log-rolling,' as it is called, millions of dollars were disposed of in projects not then required for public accommodation, and the Commonwealth, in place of one canal, was, by the log-rolling, rolled into three or more, at an expense we think, now (1829) alarming to many of those friends who in their zeal were carried along with the general current."

Another writer, in commenting upon the legislative provisions made, from time to time, for commencing works contrary to every dictate of sound policy, summarized the case as follows:—

"This course was the more imperative because there was a minority, respectable in point of zeal and numbers, and formidable by talents, who were hostile to the measures *in toto*, either from nar-

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* "Your committee regard the plan of the original improvement system of the state as founded in wisdom; and the only subject of regret is that its friends, from time to time, in the legislative councils of the state have been obliged to vote for other purposes, and for local canals and railways till it has become involved in a heavy and oppressive debt. This fact cannot be explained away or denied."—From proceedings of an Improvement Convention of delegates from Luzerne, Susquehanna and Bradford counties held at Tunkhannock, May 5th, 1840.

† Inland Navigation and Internal Improvements as now prosecuted in Pennsylvania (1829), by a freeholder of Franklin county, p. 4.

row, contracted views, from doubts of the practicability of the measure on the large scale contemplated, or from dread of the enormous expense with which it must be attended. If to this minority, any, even a small number, of the friends of internal improvements were to be added, who might oppose the system, if their interests were not properly and promptly provided for, the measure, which at best was far from being quite certain of success, would have been inevitably prostrated. It was therefore imperiously necessary to conciliate these members as the *sine qua non* of success. This is what is vulgarly called 'log-rolling,' the result of a spirit of compromise."*

Again, the evidence of Governor Ritner is to the point. Referring to the public works in his message† to the legislature of December 6th, 1836, he said:—

"Pennsylvania has 600 miles of completed canal and 120 of finished railroad. Yet such has been the ruinous and detached system pursued in their construction, that only 455 miles of this whole length are now to any useful extent in operation. The Susquehanna division from Duncan's Island to Northumberland, 39 miles, the whole of the North Branch, 73¾ miles, the West Branch, 72 miles, the Beaver division, 24¾ miles, the French Creek division, 22¼ miles, and the French Creek Feeder, 23 miles, forming a length of canal 254¼ miles, as will appear by the report of the canal commissioners, scarcely pay their lock-keepers, though a great portion of them have been completed for years."‡ Reference was then made by contrast to the main line, whose revenue was more promising. The conclusion is:—"The difference arises from the fact that the one class of improvements are not only complete in themselves, but have completed the object of their construction; while the others are mere disjointed beginnings of an immense whole, whose plan was never perfected, and whose present condition is a sad proof of the selfishness of sectional jealousy and log-rolling legislation."

It seems hardly necessary to supplement these quotations by others that are available§ in order to arrive at the correct reason

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* Carey, Brief View of the System of Internal Improvements of the State of Pennsylvania (1831), p. 13.

† J. H. Rep., 1836-7, II, pp. 28-29.

‡ The canal commissioners in their report for 1836 stated that the revenue from the public works was derived almost entirely from the main line.

§ Niles' Reg., XXXVII, p. 212; Publius, The State Debt, p. 11; Report on Inland Navigation and Internal Improvement read in the House of Representatives, Feb. 26th, 1829, p. 5; Report of House Committee relative to the Gettysburg Railroad, in J. H. Rep., 1838-9, II, Part II, p. 16.

for the adoption of the improvement policy of 1827. The shape of the State of Pennsylvania and the wide distribution of its inhabitants were such that no one leading line, sufficiently far reaching in its benefits, could be selected upon which the concentration of the energies of the commonwealth might be exclusively directed to the entire satisfaction of all the districts. The natural outcome of this was exactly what took place, viz.—the adoption of a policy of mutual accommodation. The case is clear that this programme was forced upon the party in favor of first building the main line. Once adopted, however, its continuance was regarded as essential to the preservation of the public faith; and the inevitable outcome was the chain of log-rolling legislation which marked the progress of the public works until their completion.

In conclusion, a work is necessary regarding the causes for the renewed expansion commencing in 1836. At this time, the fever of internal improvements was raging throughout many states in the Union,* and Pennsylvania was no exception. Moreover, as will be seen later, as extensive patronage had now grown up under the past expenditure of nearly $23,000,000 upon the public works. Again, in addition to the fact that the faith of the state had been pledged already to those districts in which new works now were undertaken, two other events occurred about this time profoundly influencing the situation. These were the distribution of the surplus revenue† and the chartering of the Bank of the United States. By these events, between five and six million dollars were thrown into the public treasury.‡ All these conditions combined

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* Bourne, History of the Surplus Revenue of 1837, p. 126. Niles' Reg., XLVIII (June 6th, 1835), p. 238, says:—"Canals and railways are multiplying with such rapidity over the country that it is next to impossible to keep pace with them."

† The bill for the distribution of the surplus revenue of the United States was signed by the President on the 23d of June, 1836. In accordance with this law, Pennsylvania received $2,867,514.78. Some of this money was used for educational purposes. The rest was placed in the public treasury and used largely for paying the interest on the public debt and for the extension of the transportation improvements.

‡ "Unfortunately for Pennsylvania, two circumstances occurred about this time [1836] which in their consequences have been more disastrous to her best interests than all the other evils which she has been subjected to. It will easily be perceived that the circumstances alluded to were the distribution of the surplus revenue, and the chartering of the Bank of the United

to extend the improvement system, and the most extravagant schemes were at once undertaken. When, in the face of impending bankruptcy, a halt had to be called, no revenue could be expected from the new ventures without a further expenditure of many millions of dollars. The influence of the chartering of the Bank of the United States will be more fully considered in connection with the financing of the public works, and it is to this aspect of our subject that attention will now be given.

Chapter IV.—Finance.

The Act of April 11th, 1825, which created the first board of canal commissioners, was the first also to provide for the preliminary arrangements in the financing of the public works. By it, the new board was directed to inquire into the means most suitable for establishing a canal fund; to ascertain the terms upon which loans could be obtained; and to devise means for meeting the interest and for the final payment of the principal.

Their report of February 3d, 1826,* upon these various matters, contained numerous recommendations which were embodied in an Act of legislature of April 1st, 1826.† This date, it will be recalled, was about a month after the construction of the first sections of the trunk line had been authorized. This initial financial legislation provided for the establishment of an "internal improvement

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States. By these two transactions, between five and six million dollars were thrown into her coffers. Intoxicated by the sudden acquisition of so large an amount of money, instead of husbanding it with proper care, as she should have done, the most extravagant schemes of improvement were undertaken, which now involve us in the difficulties with which we find ourselves surrounded, and which yet require the expenditure of millions upon millions to ensure completion."—Minority Report of Committee on Inland Navigation and Internal Improvements, in J. H. Rep., 1840, II (Part II), p. 255.

"These habits of lavish and ill-judged appropriations, engendered by the sudden and unexpected acquisition of public money, through means which can seldom if ever happen again, must be promptly corrected. It is frequently observed in the case of private individuals, that the sudden acquisition of wealth is fatally injurious to the prudent habits and sound morals of the possessor. It is more emphatically true in the case of governments. . . . The enormous and unprecedented deficit in the treasury now to be supplied is an instructive commentary on its practical results."—Extract from Governor Porter's Message, in J. H. Rep., 1838-39, II (Part I), p. 521.

* See J. H. Rep., 1825-26, II, p. 232.

† Laws of Pennsylvania, 1825-26, p. 168.

fund" of which the secretary of the commonwealth, the auditor general, and the state treasurer were made commissioners. All sums vested in them were to be used to pay the interest on loans* contracted for building the canal, to purchase the principal of such debts, and to defray all expenses incident to the management of the fund. The sources of the latter were as follows: "All appropriations, grants, and donations" made by the state legislature, by the Congress of the United States, by corporations or individuals; an annual appropriation† of $30,000 from the auction duties;‡

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* The practice of borrowing on the credit of the state had commenced previous to the period under discussion, although to a very limited extent. In the year 1826, when the commonwealth commenced the system of internal improvements, the debt was $1,840,000.[1] The report of the committee on ways and means[2] made to the legislature in 1823 expressed the regret that Pennsylvania has adopted a system of borrowing. The time was anxiously anticipated when the state should be free from debt. If the policy of spending more than the legitimate revenues supplied were continued, the result must be taxation or a state-debt. They believed "that neither our form of government nor the habits or disposition of our citizens is calculated for either debt or taxation; but if one or the other must be adopted they would prefer taxes rather than debt." This preference, however, was not embodied in their recommendations of ways and means since they advised "the passage of a law authorizing the governor to obtain on loan from the Philadelphia Bank the sum of $100,000 . . . to renew the loans with the Pennsylvania Bank as they shall fall due, and to make such other loans as the exigencies of the state may require . . . for any time not exceeding four years." The reason for recommending the continuance of a policy adverse to their convictions was:—"The great scarcity of a circulating medium in the interior of the state would make it very difficult if not impracticable to raise money by any general system of taxation."

† During the year 1826, however, the state treasurer was authorized to pay the commissioners of the fund, out of the receipts from duties on auctions, such sums as might be necessary to meet the interest on loans authorized during that year for canal construction. After December 1st, 1826, $30,000 annually were to be paid into the improvement fund out of the auction duties.

‡ Auctioneers were required to be licensed. They were allowed a fixed percentage on their sales, and along with this commission they had to collect for the use of the state, an additional one per cent. The bonds given by the auctioneers were security for the payment of the collections made for the state. Four times a year the duties thus collected were paid into the treasury.—See General Index to the Laws of Pennsylvania, 1700-1812, p. 47.

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[1] Report of Joint Committee on Pennsylvania's finances from 1838-43, read in the House, May 15th, 1878.

[2] See J. H. Rep., 1822-23, p. 820.

the net proceeds of escheats; the dividends accruing on the canal, road, and bridge stock owned by the state; also the tolls to be taken on the public works when built. Let us now endeavor to make a fair estimate of the yearly revenue thus diverted into the improvement fund.

In any safe system of finance, the "appropriations, grants and donations" could scarcely be regarded as sources of any sure revenue. Hence it seems fair to say that such contingent contributions should have little or no weight in computing the strength of the fund in question. The second item, viz., $30,000 from the auction duties, could be depended upon as always forthcoming, since this was only a small fraction of the yearly revenue derived from that tax.* The net proceeds of escheats was but a minor fund, also uncertain. In 1827, it amounted to $2,040.35, but for the next three years it averages only $485. One thousand dollars per year was certainly as much as could reasonably be expected from this source.† For a number of years following 1826, the dividends on the state stock diverted to the improvement fund averaged $29,000, and as the yearly income from this source had usually approximated this figure it could quite safely be depended upon as forthcoming. Finally, the revenue to be derived from tolls depended wholly upon the future. The fund could not be augmented from this source for several years, however great might be its contribution in time to come. Consequently we find that the sums that might reasonably be collected yearly to constitute an interest fund were approximately as follows:—

Auction duties	$30,000
Escheats	1,000
Dividends on canal, road and bridge stock	29,000
Total	$60,000

Computing interest at five per cent., the market rate when prevailing, this sum was sufficient to pay the interest upon loans of $1,200,000. The estimated cost of constructing the through line

* In 1826, the auction duties amounted to $108,820.06 and for several years afterwards they were never less than this sum. See Hammond, Tabular View of the Financial Affairs of Pennsylvania, p. 14.

† The average yearly income from this source for the twelve years following 1827 was $1,061.—Hammond, Tabular View of the Financial Affairs of Pennsylvania, p. 17.

from Middletown to Pittsburg as originally designed was, as has been shown, $3,000,000. Moreover, the time to construct the works was put down as six years. Hence it is clear that the provisions made, at this time, for financing the Pennsylvania canal were entirely inadequate and unsafe, even though the original plan of construction had been adhered to, and the estimated cost had been correct.

Since New York's canal had been completed before Pennsylvania's works were commenced, and since both states depended upon loans to pay the cost of construction, the question naturally arises at this point as to whether the latter state modelled its system for financing the public works upon that of the former. In order to answer this question it may be well before entering upon a consideration of the actual working out of Pennsylvania's financial arrangements to compare the "internal improvement fund" with the "canal fund" of New York.

In 1817, when the construction of the Erie and Champlain canals was about to be commenced, a sound policy for financing the works was adopted.* It appears that no reliance whatever was placed upon prospective tolls. But a fund was constituted which, without possibility of failure, should meet the interest on the loans contracted to construct the public works. To this end, the taxes on steamboats, on salt, on goods sold at auction, and some other minor dues were diverted from the "general fund" to a special "canal fund." The latter was placed under the charge of the canal commissioners, who were expressly required to limit their loans so that the total annual interest should, in no case, exceed the income of that fund. Again, after the canals were constructed, and when tolls were coming in freely, the latter, along with the salt and auction duties, were put into a sinking fund, for the extinguishing of the debt of $7,737,771 incurred in building the canals. Moreover, it was definitely provided that no use should be made of these revenues for any other purpose whatsoever. In making these arrangements it was generally understood that the object was to discharge the debt, to restore to the "general fund" the moneys diverted from it, and to remove forever all danger of a resort to taxation. Thus it

* The facts given here regarding the provisions made for financing the Erie and Champlain canals are found in Hunt's Merchants' Magazine, Vol. XVIII, 1848, p. 245, and in a Report of the Ways and Means Committee of the Assembly of New York, March, 1838.

is evident that a clear, safe and well-defined policy was laid out and pursued, viz.—to contract no debts without arranging beforehand, beyond the possibility of doubt, the ways and means of paying the interest and later the principal itself.

In accordance with these plans, the funds for meeting interest payments were always ample, and the part of the improvement debt falling due in 1836 was easily paid. The balance remaining in the sinking fund, at this time, was $3,931,132, and the remainder of the debt which did not mature until 1845 was only $3,762,256. The latter would have been discharged at once, had it been possible to get the state's creditors to surrender their certificates at a reasonable figure. There being no longer any need of augmenting the sinking fund, legislation was passed in 1836 providing for the restoration to the "general fund" of the salt and auction duties, also for diverting $200,000 annually from the canal revenues to the same fund.

It thus seems clear that the meagre provisions made by Pennsylvania for financing the trunk line were not copied from New York. On the contrary, the sound policy of the latter state affords a striking contrast to that of the former. The inevitable result of such negligence of duty on the part of Pennsylvania was that, within a short time, the interest fund was exhausted. An acknowledgment of this fact by the commissioners* resulted, as we shall soon see, in a temporary decline of the credit of the state.

The first loan† negotiated to secure funds to commence the construction of the public works was for the sum of $300,000, authorized by an Act of April 1st, 1826.‡ From this time until 1842, the period of the active prosecution of the state improvements, $53,352,648.72 were expended by the commissioners of the internal improvement fund. Indeed, within two years from the date when the first ground was broken, permanent loans had been floated amounting to $3,300,000 and the work of construction was only fairly under way. As early as 1829, the confidence of "capitalists and moneyed institutions" had become shaken respecting the sufficiency of the fund pledged for the payment of interest. So great

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* See Report of the Commissioners of the Internal Improvement Fund for February 19th, 1829, in J. H. Rep., 1828-29, II, p. 589.

† The rate of interest was 5 per cent., and the stock sold at a premium of 3⅝ per cent.

‡ Laws of Pennsylvania, 1825-26, p. 168.

was the alarm at this time, that not a single bid was made for a permanent loan for $2,200,000 authorized by an Act of April 22d, 1829.* This was not due to any tightness in the money market, for, in the words of Governor Shultze, "the canal stock of a neighboring state commands a premium abroad, while that of this no less worthy commonwealth is in no demand and will not sell at all."† Moreover, it was only with great difficulty that money could be obtained on temporary loan to meet the urgent demands on the improvement fund.‡ The suspicions of the "capitalists and moneyed institutions" concerning the sufficiency of the fund for interest payments were not without foundation. The commissioners, in their report of February 19th, 1829, made no attempt to conceal the actual conditions when they predicted a "deficiency of money belonging to the fund on the 1st of February, 1830, to meet the semi-annual payment of interest on loans due on that day, of $53,880." On the date mentioned, the amount of interest to be paid was $157,500, and had not $100,000 then been transferred§ from the state treasury to the internal improvement fund, there would have been a deficit of $70,338.81. Again, on the 1st of August of the same year the deficit was $77,838.81, although in the meantime a similar transfer of $25,000 had been made. Furthermore, in the face of these difficulties a temporary loan was authorized on November 17th, 1829, to provide, among other things, for the payment of maturing interest. This one act of emergency legislation would not be considered unfavorably had not this make-shift policy for a number of years afterwards been frequently repeated.‖

The failure to negotiate the loan of April 22d, 1829, and the increasing deficit in the interest fund were the cause of serious thought on the part of the executive and the legislative officers of the state. Moreover, at the close of 1829, the sum of $1,398,790.67 was due to various contractors, many of whom, on account of delay

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* See Gov. Wolf's message in J. H. Rep., 1831-32, II, p. 19.

† Message of November 4th, 1829, in J. H. Rep., 1829-30, II, p. 5.

‡ See Gov. Wolf's message in J. H. Rep., 1831-32, II, p. 19.

§ By an Act of April 22nd, 1829, the state treasurer was authorized to pay to the commissioners of the internal improvement fund to be applied to the interest account any money not otherwise appropriated, which, in the opinion of the commissioners, could be done without embarrassing the ordinary operations of the treasury.

‖ See J. H. Rep., 1836-37, II, p. 22.

in obtaining their pay, were in distressing conditions.* In his message of January 14th, 1830, Governor Wolf discussed at length the whole situation. He pointed out the complete inefficiency of the improvement fund to meet the interest on the existing loans of $8,300,000, and on the additional sums that, sooner or later, must be borrowed to complete the works. In order to create an interest fund which should be both ample and permanent, he strongly advised taxation. Again, in their report of February 22d, 1830, the house committee on ways and means stated that it was "the imperative duty of the present legislature to adopt effective measures to guard against any possible deficiency to meet the engagements of the state."† Furthermore, they mentioned that, in view of the rapidly increasing interest charges on the loans, which then aggregated nearly $10,000,000,‡ they would recommend, later, a system of taxation to supplement the present sources for interest payment. The effect of these and other expressions of determination to strengthen the interest fund was shown, even before any action was taken in this direction, in the rise of the credit of the state. For between March, 1830, and December, 1831, $386,989.71 were paid into the treasury as premiums on stock loans,§ and diverted to the fund for interest payment. During this time, to use the words of Governor Wolf, "capitalists and moneyed institutions vied with each other as to which of them should obtain the state loans,..... in the entire confidence that an adequate fund for the punctual semi-annual payment of the interest would be established."||

In this matter, however, they were over-sanguine. For the taxation bills reported by the committee on ways and means were by no means as extensive as had been assured, nor were they adequate to the ever-increasing demands for interest money. They were as follows:—First, a tax of one mill on the dollar upon personal property not subject to county rates and levies; second, an increase of one

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* See J. H. Rep., 1829-30, II, p. 574.

† J. H. Rep., 1829-30, II, p. 663.

‡ The whole amount of money appropriated for the state works up to December 10th, 1830, was $10,288,309.69. See Haz. Reg., VII, p. 12.

§ The permanent loans upon which this amount of premiums was paid aggregated $6,783,161.88. They were placed at 5 per cent. and all sold at a premium. See Hammond, Tabular View of the Financial Affairs of Pennsylvania, p. 9.

|| J. H. Rep., 1831-32, II, p. 19.

mill on the dollar on all county rates and levies; third, a tax on inns and taverns, expected to add $40,000 yearly revenue; fourth, a tax on judicial proceedings such as recording deeds and mortgages, estimated as capable of swelling the annual revenue by $50,000; fifth, an alteration of the law concerning the retailing of merchandise, so as to give an increase of $40,000 annually.

By the time the above recommendations had been fully discussed in both houses of the legislature, items three, four, and five were cancelled, and only the first two were included in the tax laws of March 25th, 1831. These were to be kept in force for five years, and would therefore have expired by limitation in March, 1836, had they not been repealed previously.* They were designed to help replenish the interest fund, only until the revenue expected from the public works should be ample to meet this and many other purposes.†

It is hardly necessary to say that the above tax laws were unimportant and entirely insufficient. In fact they may have been designed by the legislature rather to raise credit than actual revenue. During the period of almost five years in which they were in force, the total amount of revenue collected was only $1,052,650.78.‡ By 1835, the last year these laws were in force, the yearly interest on the improvement loans slightly exceeded this figure.§ Certainly no further facts are necessary to demonstrate the futility of the taxation policy of 1831.

In spite of the failure of the legislature to create an interest fund which should be "both ample and permanent," no further trouble was experienced for some time in securing, upon easy terms, the money necessary to carry on the public works. In fact, all the loans floated for the purpose of bringing the improvements to completion in 1834 bore a substantial premium.|| For instance, the 5 per cent. stocks of 1832-33, to the amount of $2,500,000, redeemable in 1860, sold at almost 15 per cent. above par.¶ The reasons for this are apparent. In the first place, the expressions of determination to preserve the credit of the state, at the time of its temporary decline in 1829, tended to make the money lenders confident regard-

* They were repealed on February 18th, 1836.

† See J. H. Rep., 1831-32, II, pp. 20-21.

‡ Hammond, Tabular View of the Financial Affairs of Pennsylvania, p. 14.

§ Ibid., p. 11.

|| Ibid., p. 9.

¶ Hunt's Mer. Mag., XX, 1849, p. 260.

ing the security of their loans. But of no less importance than this was the influence of the general financial condition of the country. Both at home and abroad, money was abundant and the expansion of state and individual credits was exceedingly popular.* The spirit of speculation was by no means confined to this state, but it was raging all over the country. Banks were created in great numbers† and became the instruments of the expanding credit mania. Under these conditions, Pennsylvania had no trouble to sell her stock profusely to provide means for completing her extensive system of public improvements. Moreover, the funds thus secured were from time to time freely drawn upon to pay the interest on previous loans.

As a result of this policy, when the main line and lateral works had been completed and were coming into general use in 1835, the state debt was $24,589,743.32.‡ The greater part of this ($22,420,003.32)§ had been incurred in the construction of canals and railways. The whole of this sum had been borrowed at 5 per cent. and had yielded to the treasury in premiums on the respective loans the sum of $1,356,653.36.|| Moreover in this year, the ordi-

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* "States, banks, corporations and individuals all moved forward in harmonious unison, borrowing all they could and wherever they could, without reference to their future ability and means of repayment."—Extract from Governor Porter's Message, in J. H. Rep., 1840, II, p. 19.

"During the ten years following 1820, public stocks were authorized in the various states to the amount of $26,000,000, of which nearly $18,000,000 were held against the three states, New York, Pennsylvania and Ohio. Between the years 1830 and 1835, $40,000,000 were added to the obligations of the states, while the three years previous to 1838 witnessed an increase of local indebtedness to the amount of $107,000."—Adams, Public Debts, p. 318.

† *Banks in the United States.*

	Number	Capital	Loans and Discounts	Circulation	Specie
1820	303	$137,110,611	$189,252,422	$ 44,863,344	19,820,240
1830	330	145,192,268	200,451,214	61,323,896	22,144,917
1837	634	290,772,091	525,115,702	149,185,890	37,915,340

—See Governor Porter's message of January 8th, 1840, in J. H. Rep., 1840, II, p. 15.

‡ See Governor Shunk's message in Exec. Docs., 1845, p. 6.

§ See Governor Wolf's annual message of Dec. 2d, 1835, in J. H. Rep., 1835-36, II, p. 11.

|| Ibid., p. 11.

nary revenue, exclusive of loans, was $1,643,923.21, of which $562,690 was from taxes, and $684,357.77 from canal and railroad tolls. The interest payments, in 1835, totalled $1,169,455.69, a sum, as will be seen, nearly equal to the entire revenue. In the face of such unsound financial conditions, economy in all matters of public policy and a reinforcement of the tax laws of 1831 would naturally have been expected. On the contrary, however, a wide extension of the internal improvement system was commenced, and the above-mentioned laws were repealed. Let us now examine the circumstances giving rise to such action.

The charter of the Bank of the United States was to expire March 3d, 1836. As early as November preceding this date, projects began to be discussed for getting from Pennsylvania a state charter. This scheme soon became popular, for it appeared that there would be obtained in this way by the state a large sum of ready money, as well as the means for placing loans upon easy terms. Furthermore, the extensive patronage which had already grown up under the past expenditure of nearly $23,000,000 among jobbers and contractors, as well as under the appointment of numerous operators on the public works, naturally produced a strong party in favor of any movement which would provide for their extension. Besides, many could be found anxious to endorse any reasonable plan to avoid paying taxes. Accordingly, on February 18th, 1836, a bill was passed entitled "An act to repeal the state tax on real and personal property, to continue and extend the improvements of the state by railroads and canals, and to charter a state bank to be called the United States Bank."* This act, then considered the means for effecting the financial redemption† of the state, has been justly characterized as follows:—

"The act of the Pennsylvania Legislature, by which the United States Bank of Pennsylvania was chartered, is, on its face, a piece

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* Laws of Pennsylvania, 1835-36, p. 36.

† Governor Ritner, in his annual message for 1836, in speaking of this act said: "The increase of the state debt is arrested. The state tax has been permanently repealed. Loans for the payment of interest, that infallible precursor of private as well as public bankruptcy, have, I trust, forever ceased. . . . . The whole of this healthful and cheering change was produced by one well-time, wise and truly Pennsylvanian act of legislation. The Bank of the United States . . . . . became, as a State institution, the means of producing for Pennsylvania that financial redemption which it had formerly effected for the Union."—J. H. Rep., 1836-37, II, p. 22.

of corrupt legislation. Its corruption was addressed to the people of the state, not to private individuals. It comprised three projects in an obvious log-rolling combination,—remission of taxes, public improvements, and bank charter."*

The first section, as before mentioned, repealed the tax laws of 1831, and thus left the state almost taxless. By other sections, more than two millions of dollars were appropriated at once, for the extension of the transportation improvements. Furthermore, in consideration of the privileges conferred upon the bank by this act, and in lieu of all taxes on dividends, it was to pay into the treasury of the commonwealth the sum of $2,500,000, and a further annual sum of $100,000 for twenty years† for common school purposes. It was also pledged to advance on permanent loan any sum or sums not exceeding in the whole $6,000,000, in return for which the state was to issue negotiable certificates of stock, reimbursable in 1868, bearing interest at 4 or 5 per cent. per annum payable half yearly. It was provided that, if the interest should be at 4 per cent., the loan was to be taken at par; but if at 5 per cent., the bank must pay a premium of 10 per cent. Again, the bank was obliged to advance to the commonwealth, as a temporary loan, at 4 per cent. any sum, not exceeding $1,000,000 a year, reimbursable at the pleasure of the commonwealth, within twelve months from the date of the loan; also it was to subscribe $675,000 to the stock of certain railroad and turnpike companies. Such were the considerations deemed equivalent to the privileges granted to the bank by its new charter.

The rechartered bank, which, at best, was a most unstable institution, now entered upon a period of intimate relationship with the state's finances. It attended to the transfer of state stocks, was by law the depository of the state's funds and was the agency through which the semi-annual interest payments were made.‡ The rapid extension of the public improvements which now followed made it necessary that the state, in accordance with the conditions of the charter, should draw heavily from the bank. But, soon after the latter undertook to make these large payments, the money market throughout the country began to tighten, and increasing strin-

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* Sumner, Andrew Jackson as a Public Man, p. 338.

† The charter was granted for a period of thirty years.

‡ See J. H. Rep., 1836-37, II, p. 22, and 1837-38, II, pp. 33 and 82; also Hunt's Mer. Mag., XX, p. 261.

gency was followed by the universal suspension of 1837. This was not without effect upon the state's credit abroad. For a large proportion of the state's stock was held by foreign stockholders,* and, owing to the generally deranged state of credit in 1837, the August interest payment was delayed. This was inevitable since the United States Bank of Pennsylvania, which was now the state's banker, had failed on the 18th of May. Most of the foreign creditors usually authorized the bank to transmit the amounts due to them semi-annually to Baring Brothers and Company,† who credited these sums to their respective accounts in London. Remittances were made customarily in bills of exchange, but at this time no satisfactory bills could be procured.‡ Accordingly, it was not until the 16th of December that the August interest was forwarded.§

This delay occurring at the very time when financial embarrassment was becoming general, and when the stocks of numerous states were flooding the foreign markets,‖ was soon followed by a decline of the state's credit abroad. By 1839, Pennsylvania's 5 per cent. stocks, which, in 1833, had sold in Europe for 115, would not sell at all.¶ Before the close of the year 1838, the extraordinary rev-

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* In July, 1842, according to a return submitted to the Senate of Pennsylvania by the Auditor General, the distribution of the state debt was as follows:—Held by citizens of Pennsylvania, $9,635,613.47; by citizens of other states of the United States, $1,080,537; by subjects of Great Britain, $20,026,458; by subjects of other foreign states, $3,711,748; total, $34,454,356.47.

† This firm was the agent for a large percentage of the foreign holders of Pennsylvania's stocks.

‡ See J. H. Rep., 1837-38, II, pp. 33 and 82.

§ The bank allowed interest at 4 per cent. for four months on the delayed interest payment and 12½ per cent. premium was paid for the bill of exchange on London. See J. H. Rep., 1840, II, p. 45.

‖ The amount of the state stocks authorized to be created by eighteen states, in each period of five years, from 1820 to 1838, was as follows:—From 1820 to 1825, $12,790,728; 1825 to 1830, $13,679,689; 1830 to 1835, $40,002,769; 1835 to 1838 (say 3½ yrs.), $108,223,808; total $174,696,994.

The above is taken from Governor Porter's message of January 8th, 1840, in J. H. Rep., 1840, II, p. 17, and agrees substantially with footnote (*), on page 213. Note that the greater proportion of the stocks was created after 1835. Nearly two-thirds of Pennsylvania's stocks were held abroad and large quantities of those of other states were similarly held.

¶ See Governor Porter's message for Jan. 8th, 1840, in J. H. Rep., 1840, II, p. 19. See also Governor Ritner's message for December 27th, 1838, and Hunt's Mer. Mag., XX, 1849, p. 261.

enue, including the bonus received from rechartering the Bank of the United States, and the surplus revenue, had all been spent.* Moreover, in his report of December 8th, 1838, the state treasurer estimated that on October 31st, 1839, there would be a deficit of over $3,000,000. To meet this emergency new loans were offered in 1839, but no bids were received. So, in accordance with the conditions of the charter, the United States bank was forced to take them. With no market at home or abroad for these stocks received in exchange for its own notes, the bank, in October, 1839, was obliged again to fail.† With $1,800,000 interest to be paid per year, with large sums due the contractors on the works, with little or no credit abroad, and with its own financial institution bankrupt, the legislature at last was forced to take action. This was not, however, until it was too late to avert a crisis. Consequently, for nearly three years following the date of the second failure of the bank, the state was engaged in a desperate struggle to avoid defaulting its interest. Let us now see what efforts were made to preserve its credit.

As early as December, 1838, the state treasurer, in discussing various financial matters,‡ recommended as desirable, in accordance with the soundest principles of public policy, the adoption of an adequate system of taxation. This plan, however, was not endorsed by Governor Ritner in his message§ three weeks later. The following January, Governor Porter, in drawing the attention of the legislature to the big deficit inevitable in 1839, stated that two alternatives were open to them to secure the necessary funds, viz.—taxation and loans. "Of the two," he said, "the latter appears least objectionable because productive of least hardship to the people, is less expensive, and can be carried into effect with greater facility." In January, 1840, the state treasurer again pointed out the necessity of checking the ruinous policy of finance, and resorting to taxation.|| By this time Governor Porter's views

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* See J. H. Rep., 1838-39, II, Part II,—Report of the State Treasurer.

† This was on the 9th day of the month. On Feb. 4th, 1841, it failed for the third time.

‡ See Report of State Treasurer for Dec. 8th, 1838, in J. H. Rep., 1838-39, II, Part I.

§ J. H. Rep., 1838-39, II, Part I, pp. 6-18.

|| See Report of State Treasurer for Jan. 9th, 1840, in J. H. Rep., 1840, II.

had completely changed, for now he sounded aloud the cry for financial reform.*

He seems to have been the first public man of prominence to call attention to the fact that, financially, the state works had been a failure; accordingly, he now felt it his duty to exhibit their actual productivity in a manner somewhat less flattering than that usually represented. Hitherto it had been the custom to state the gross amount of the tolls as if the works had yielded that amount clear of all expenses. The fact was that the yearly revenues for the last five years had exceeded the expenditures, on the average, only $139,697.43. During the same period, however, the average yearly interest on the sums borrowed to construct the works had exceeded $1,200,000. Governors, legislators and the people had all deceived themselves concerning the public works, yet they had embarked in them too deeply to turn back. Their speedy completion was urged in the hope that soon the brilliant anticipations of the early friends of the system might be realized.

With reference to the general financial affairs of the commonwealth, the governor did not hesitate to reveal the exact conditions. The public debt had reached the enormous sum of $34,141,663.80, while the ordinary expenditures for the past year had exceeded the ordinary revenues from all sources to the amount of $1,087,743.63. He said:—

"The affairs of the commonwealth have been, for several years, gradually verging towards deeper and deeper embarrassment, until we have at length reached this unexpected deficiency of funds in the treasury to meet the demands upon it. The people have been told again and again that our fiscal condition was flourishing and prosperous, while, in fact, our prosperity was all based on paper calculations and loans, which loans, we are just now beginning to perceive, bear interest, and are some day to be paid. We are now compelled to forego all temporary expedients, and to look the true state of things in the face. We must resort to taxes, the sale of the public improvements, or to further loans. The public improvements cannot be sold but at a most ruinous sacrifice; and, as to loans, it is doubtful whether we can procure them at all unless at an unwarranted rate of interest. Notwithstanding all these difficulties, the sum due by the state must be paid. To obtain the means, we have at best a choice of evils, and we ought to select that which will

* See his message of Jan. 8th, 1840, in J. H. Rep., 1840, II, pp. 19, 20, 21, et seq.

impose on the people of the commonwealth the least inconvenience and detriment. . . .

Until with the last year we have been able, not only to borrow money without difficulty on state stock in Europe, but to pay the interest arising on former loans by new ones. We felt little of the inconvenience of this bloated system of credits, and seldom reflected that a day of reckoning would come, when we could thus pay our debts no longer. The delusion is at last over. . . The time for sober reflection has arrived. . . The question is presented to the consideration of the legislature, how is the money to be procured to pay the interest on the state debt, to meet the loans falling due, and to defray the other necessary expenditures of the commonwealth? The sum of $2,000,000 must be obtained for the ensuing year, . . . My own deliberate opinion is that, resort to taxation, provided that it shall be so regulated as to bear with as little hardship as possible on the people, is the only possible remedy to extricate the commonwealth from the embarrassments by which we find her surrounded. The state has actually been compounding, for years past, from a million to a million and a half of interest annually; and the question is now submitted whether we are thus to continue adding half-yearly this enormous amount of interest to the principal of our state debt, and continue in this course of policy, from year to year, of shuffling off the evil day, and entailing this frightful legacy on posterity. . . Taxation would pay the interest, it would eventually constitute a sinking fund to pay off the principal of the state debt and should be continued until the income of the public improvements would render longer taxation unnecessary."

The committee on ways and means, to whom was referred the above sections of the message, recommended an immediate resort to taxation. Accordingly, on the 11th of June, 1840, a law* was passed, to continue in force for five years, imposing a tax of one mill on the stock of banks or other institutions making or declaring dividends; half a mill on certain personal property; a small tax on household furniture, pleasure carriages and watches; and a tax on the salaries of state employees.

It was computed that the revenues to be collected according to the provisions of this act would amount to $600,000 annually.† It was found very difficult, however, to put the taxing machinery at once into operation, so that the law of 1840 failed to become really effective until the state had defaulted its interest. Thus, for the fiscal year ending November 30th, 1841, although the amount of

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* Laws of Pennsylvania, 1840, p. 612.

† See J. H. Rep., 1841, II, p. 7.

tax assessed was $416,794.85, only $33,292.77 were collected. Again, in 1842, but $486,635.85, including arrears, were received, while for the fiscal year 1844 out of $751,210.11 paid into the treasury only $143,099.06 were collected from the assessments of that year. But, had the full $600,000 been collected annually, this amount would have been entirely inadequate to preserve the state's credit.

The Act of May 4th, 1841,* entitled "An Act to provide revenue to meet the demands of the treasury, and for other purposes" was a new device to help meet the pressing needs of the time. By it provisions were made for borrowing not more than $3,100,000 under the following prescribed conditions:—Certain banks in the state were authorized to subscribe to the stocks issued. The amount of these subscriptions, in notes of the respective banks of the denominations, one, two and five dollars, was to be placed in the state treasury. The paper thus authorized to be issued was to be withdrawn from circulation on or before May 4th, 1844. These notes were exchangeable, upon presentation to the bank of issue in amounts of not less than $100, for an order on the auditor general for a certificate of an equal amount of stock created for their redemption. The banks got one per cent. interest on the notes until they were redeemed. Moreover, they were to be received in payment of debts due to the commonwealth, they could be re-issued, and each bank issuing them was required to receive its own notes at par in payments due to it. It was thought that, by making the redemption of the new issue depend upon the good faith of the state as well as upon that of the banks, a safe and reliable currency would be constituted.† The amount of this paper, popularly known as "relief notes," that was issued originally was $2,220,265. As might be expected, it rapidly depreciated‡ and soon became the only medium in which the state received its revenue. Consequently, instead of helping the state out of its financial embarrassment, the relief notes made matters worse.

And now came the climax to the steady progress towards state bankruptcy. By resorting to the various expedients already men-

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* See Laws of Pennsylvania, 1841, p. 307. This act was passed over the governor's veto.

† Hunt's Mer. Mag., XX, 1849, p. 261.

‡ In 1842 the notes were at a discount of from 10 to 20 per cent. For their later history see Worthington, Hist. Sketch of the Finances of Pennsylvania, p. 56.

tioned, the semi-annual interest payments had been met until August 1st, 1842.* At that date, however, the treasury was without funds, and with no means of securing them. Accordingly interest certificates† were authorized to be issued to the amount due each holder of state stocks. They bore 6 per cent. interest, and were redeemable one year from date of issue. At the same time provisions were made for the payment of a percentage of the debts owing to contractors, employees, etc., on the public works. The latter were known as the "domestic creditors." On November 30th, 1842, the books of the auditor general showed that the various amounts due them totalled $1,191,710, and, of this sum, $597,-461.74 was for work done prior to May 4th of the previous year. Again, on the 1st of February, 1843, more interest certificates had to be issued, as also for the payments that fell due the following August, and for the whole of the next year.‡

In the meantime, such serious financial embarrassment had started an agitation for the sale of certain stocks held by the state.§ To this end, by an Act of April 8th, 1843, the necessary legislation was secured, and at once stocks having a par value as follows were disposed of:—‖

Bank stocks	$2,108,700.00
Bridge stocks	524,350.00
Turnpike stocks	803,833.00
Canal, Railroad and Navigation stocks	755,500.00
Total	$4,192,383.00

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* The interest due on February 1st of this year was delayed somewhat.

† See J. H. Rep., 1843, II, p. 8, and Laws of Pennsylvania, 1842, p. 441.

‡ See Exec. Docs., 1854, p. 96.

§ At this time the state held stock in incorporated companies as follows:

86 Turnpike companies	$2,313,275.00
3 Banking companies	2,108,700.00
9 Canal and Navigation companies	852,778.66
4 Railroad companies	395,276.90
21 Bridge companies	524,350.00
Total (par value)	$6,194,380.56

‖ Other stocks in canal, railway, turnpike and navigation companies to the amount of $1,986,797.56 were put up for sale, but as the offers were small they were not disposed of. For some holdings no offers were received. See Report of Commissioners for Sale of State Stocks in J. H. Rep., II, 1844, p. 28.

The sales were made at a low figure, for all of the above realized but $1,319,730.65. Notwithstanding this fact, however, the bank stock, at least, had been a good investment, since between 1821 and 1844 it had yielded on an average 5.7 per cent. On the other hand, the rest of the holdings had returned less than one per cent.*

On November 30th, 1843, the close of the last fiscal year before financial reform was commenced, the total amount expended by the commissioners of the internal improvement fund for the various purposes of the state works was $53,352,648.72. The cost of the latter to this date had been $28,616,375, and they had yielded $9,286,644.26 revenue. The interest payments on loans pertaining solely to the improvements totalled $16,230,597.15. The balance in the treasury was only $115,466.91, while the debt still outstanding for loans was $39,240,461.40.†

As already intimated, the year 1844 saw the commencement of radical measures of financial reform. Rigid economy was now introduced in all lines of public expenditure. On the 29th of April, Governor Porter sanctioned an Act‡ providing among other things for an extensive system of taxation. This policy, hitherto adopted always as a temporary makeshift, now that the financial failure of the public works was recognized, was viewed in an entirely different manner. The provisions for taxation applied to all real estate not exempt by law; all personal estate; mortgages; money owing by solvent debtors, whether by promissory note or otherwise; with minor exceptions, all articles of agreement and accounts bearing interest; all shares or stock, in any bank, institution or company; all shares of stock in unincorporated saving fund institutions; all salaries from professions, trades, and occupations excepting farming. The same act also made adequate provisions for equalizing the assessments and taxes in the different counties, and created the machinery for imposing the provisions of the act and for making collections.§ Anyone holding interest certificates or claims for

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* Worthington, Hist. Sketch of the Finances of Pennsylvania, p. 57.

† The debt contracted solely for public works and for paying interest amounted on Jan. 6th, 1842, to $33,359,313. See J. H. Rep., 1842, II, p. 4.

‡ Laws of Pennsylvania, 1844, p. 497.

§ Governor Porter estimated that the new assessments authorized by the Act of April 29th, 1844, would yield $1,500,000 yearly. "This sum," he said, "with the other resources of the commonwealth, will be entirely adequate to

certain unpaid appropriations issued during the years of financial embarrassment, might surrender them and receive in their stead stock certificates bearing 5 per cent. interest. By the concluding clause it was enacted,—"That the whole amount of revenue to be raised under the provisions of this act shall be irrevocably appropriated to the payment of the interest on the public debt; and the said appropriation shall not be withdrawn or repealed by any general words or repealing clauses, in any appropriation bill or other act."*

The tax-payers were quick to respond to the provisions of this bill, and, in some instances, the assessments apportioned to certain counties were paid into the treasury several months before they were due.† Accordingly, it was possible in February, 1845, to resume the interest payments, and, at no period since that date has the treasury department been without means to meet every obligation.

Having now examined the manner in which the public works were financed, the embarrassments experienced from time to time, and the struggle made to preserve the credit of the state, let us consider the reasons for adopting this policy as well as the causes for the serious financial embarrassment during the years 1839-44. The latter of these two points will be discussed first.

In general, it may be said that the spirit of wild speculation was common to many of the states during a large part of the time the

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furnish the necessary amount to discharge the interest upon the public debt, and thus ensure the fidelity of the state to her engagements."—Extract from message of Jan. 8, 1845, in Exec. Docs., 1845, p. 5.

* The amount of the state debt on April 1st, 1844, was $40,051,794.18, distributed as follows:—

6 per cent. Stocks	$ 4,331,013.99	
5 " " "	32,934,763.73	
4½ " " "	200,000.00	$37,465,777.72
Relief notes in circulation bearing one per cent. interest	1,292,449.68	
Relief notes in circulation bearing six per cent. interest	171,636.00	1,464,085.68
Domestic creditors, script outstanding		166,504.65
Interest on loans due 1st Feb., 1844		955,426.13
Total		$40,051,794.18

† See Gov. Shunk's Message in Exec. Docs., 1845, p. 3.

public works were being constructed; and that the accompanying bloated system of credits had considerable influence in bringing about the subsequent general collapse affecting alike governments and private concerns. Moreover, the disturbed condition of the money market in Great Britain,* where large blocks of the state stocks were held, helped to make the situation in America all the more strained. Not to underestimate the influence of any or all of the foregoing and other factors, it seems fair to say that Pennsylvania's financial embarrassment at this time was, at least to a large extent, the result of three circumstances all of which were more or less related to one another. These were,—first, too extensive a system of internal improvements; second, alliance with an unsound banking system, especially with the United States Bank of Pennsylvania; third, unsound financial legislation.

The way in which the wholesale building of public works contributed to state bankruptcy is apparent. The more works undertaken, the faster the loans had to be floated, with the result that the public debt soon became a serious burden, and the semi-annual interest payment constituted an enormous drain upon the treasury. Had it been possible to limit the improvement system to the main line and one or two of the more important branches, it seems highly probable that the interest payments, during the years of financial embarrassment, could have been met. On the other hand, had all or even the larger part of the various divisions been as productive as the works in the original system were expected to be, the more widely the system was extended, the greater would have been the income therefrom. But, as has already been indicated, even the divisions that earned the largest revenues fell far short of the expectations of the friends of the public works. Consequently, during the years of financial embarrassment, when the great problem was to secure sufficient funds to pay the enormous interest on the loans contracted for constructional purposes, the receipts from canal tolls helped but little to ward off bankruptcy.

With regard to the part played by the banks in causing state insolvency, it seems fair to say that it was not inconsiderable. They were intimately connected with the whole subject of finance, and their influence in bringing about an inflated system of credits was

* See Dewey, Financial History U. S., p. 230; and Governor Porter's message in Exec. Docs., 1844, p. 4.

far-reaching. Hence, the banks indirectly helped on the embarrassment, by making it easy to secure funds to expand the public works. But it was more particularly by the alliance with the United States Bank of Pennsylvania that the way was opened for numerous unwise practices which, in due course, tended to make more intense the troubled monetary conditions. In this connection, the repeal of the tax laws of 1831, the immediate appropriation, for an unwarranted extension of the public works, of over two millions of dollars from the bonus received for the charter; the handing over to the bank of the management of interest payments on the state loans; the forcing upon the bank of heavy loans when no bids whatsoever could be obtained for them in the open market; and the repeated failure of the institution at critical times,—all these factors combined either to make the already intricate financial affairs of the state more complex, or they offered the means for extending still further obligations which had already become too great.

But more closely connected with the financial embarrassment during the period 1839-44 than either of the factors already discussed, was the unsound financial legislation which not only covered these years but also reached back to the very inauguration of the public works. It will be remembered that the Act of April 1st, 1826, in endorsing a resort to loans to secure funds for building public works, left the payment of interest on the estimated sum for trunk line construction inadequately provided for. Again, somewhat later, when, in order to secure the completion of the main line, a general expansion of the improvement system was found necessary, the interest fund, contrary to every dictate of prudence or sound policy, was not reinforced.* Moreover, beginning as early as 1829, loans were floated for the purpose of meeting the interest payments,† and, from this time until the commencement of financial reconstruction in 1844, the general improvement fund was drawn upon freely for the same purpose. In fact, almost every possible expedient, excepting adequate taxation, was brought into play to secure revenue to meet the ever-increasing demands upon the treasury.

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* It should be said, however, that the Act of April 9th, 1827, made provisions (sec. 17) for paying the interest on a loan of $1,000,000 authorized by the same act (sec. 15). The interest was to be paid out of the auction duties.

† Authorized by Act of November 17th, 1829.

In view of what has been said, the unsoundness of the policy adopted and perpetuated by Pennsylvania in the financing of the public works is now apparent. For the above contains numerous instances of lines of policy pursued which were contrary to the principles of any safe system of finance such as was adopted in New York. As a natural result of almost a complete dependence upon loans to build the works, and to pay the interest on the ever-increasing debt, serious complications arose. So long as the money market was easy, and the credit of the state was unquestioned, there was no need of any apprehension concerning the prompt payment of the interest. But when these conditions no longer existed, there could be no doubt as to what must be the outcome. With a constituency almost wholly unaccustomed to paying taxes, with no well-organized system of taxation ready to be put into operation in case of emergency, bankruptcy was thus inevitable.

It now remains to examine the influences which determined the adoption and persistent carrying out of this financial policy. While not overlooking in this connection the influence of the easy money market, it seems fair to say that this course was due to two principal causes, viz.—the reluctance of the people to pay taxes, and a general overestimation of the potential productivity of the public works. The evidence presented by contemporary writers indicates that taxation on general principles was peculiarly odious to the people of Pennsylvania, and that the legislators, from the dread of unpopularity, hesitated to resort to this method of raising revenue.* Moreover, it was confidently believed that if, in one way or another, sufficient money could be raised to defray interest charges until the works were completed, then the treasury certainly would be filled to overflowing with the revenue from canal and railroad tolls. In referring to the tax laws of March 25th, 1831, Governor Wolf shed much light upon the question under considera-

* "No adequate funds were provided for the payment of the interest on the loans. In some cases new loans were negotiated for that purpose. Hence, the credit of the state suffered severely, and money was sometimes borrowed on disadvantageous terms. This unmanly and discreditable conduct arose from a paltry dread of unpopularity, the imposition of taxes being at all times and in all countries unpopular; and thus the public interest was sacrificed to this unworthy motive.—Carey, Brief View of the System of Internal Improvements in Pennsylvania, pp. 15-16.

tion. He urged the people calmly to submit for a short time to taxation; cited such tax laws as provided interest money in other states, especially in Ohio; and stated with all assurance possible that, on account of the prospectively abundant revenue from the improvements, taxation could be done away with entirely in five years.* In fact, in all cases where taxes were imposed previous to 1844, this was the reason why five years was the limit set for their collection. Again, we find the commissioners of the internal improvement fund stating:—"In looking for relief from taxation, and ultimately of furnishing an ample fund for education and for the extinction of the public debt, the committee mainly rely upon the productiveness of the canals and railroads."† Even as late as 1839, it would appear that this confidence was still unshaken. For Governor Porter, in his message of January 26th, stated:—"It cannot be long before the ordinary revenue arising from the tolls of the canals and railways of the commonwealth will defray all the expenses necessary to keep them in repair, and pay the interest on the money expended in their construction."‡ Also, a month later the house committee of ways and means, in discussing the subject of taxation, voiced the same sentiment when they said:—"A well-founded hope is entertained that, in a few years, the increased value of the improvements of the state, now rapidly developing, will add sufficiently to the permanent revenue to meet the demands upon the treasury."

The above expressions of confidence in the future earning power of the public works are but samples of the numerous cases that could be cited. The sentiment contained therein, originating even before the improvements had been undertaken, seems scarcely to have been questioned until Governor Porter's message in 1840. Even then it took the friends of the improvement system some time to become convinced of its financial failure. The brilliant success of the New York works in yielding revenue doubtless was the main and visible cause of such unshaken confidence. This delusion, however, and the people's aversion to paying taxes were, it is believed, the chief influences causing the adoption and persistent continuation of that unsound financial policy which was a strong factor in bringing the state to bankruptcy.

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* See J. H. Rep., 1831-32, II, p. 20.

† Niles' Reg., XXXIV, 1828, p. 39.

‡ J. H. Rep., 1838-39, II, Part I, p. 518.

As frequent reference has been made above to the financial failure of the public works, it seems necessary, in conclusion, to give a detailed statement of their financial operations. The latter is shown in full in Appendix VI. The results there set forth in tabular form were compiled* from the successive reports of the auditor general and the state treasurer. From these have been determined the cost, revenue, and expenditures of the several finished lines of canals and railroads included in the public improvements of Pennsylvania for each financial year, from their opening until their disposal to incorporated companies. Owing to the absence of sufficient and accurate data, it did not seem possible, without completing this statistical work, to arrive at any satisfactory conclusion respecting the financial operations of the works throughout their whole history. The amount of money spent on unfinished improvements was determined as above instanced, likewise all the expenditures for the board of canal commissioners, appraisers, collectors, weighmasters, and lock-keepers and the various other items shown on page 284 which do not appear in the cost, revenue or expenditures of the works. In order to render all the above results applicable to the calculation of profit or loss resulting from public ownership of the works, they have been consolidated into a single table found on page 286. From this it appears that the cost of the finished and unfinished improvements during the whole period of state ownership was $33,464,975. If from this figure we deduct the amount added to their original cost by improper charges made to construction, viz.: $5,270,397 (of which $4,365,928 was on the main line, and $904,469 on lateral lines), we get $28,194,578 as the actual cost. The gross revenue amounted to $32,505,553. If there be added to this sum the total amount received from the sale of the works, viz.—$11,281,000, we find that $43,786,553 represents the gross amount of income to the treasury on their account during the whole period of ownership. The expenditures amounted to $24,471,225, and by adding

* A similar tabular compilation, although more extensive, since it extended to all the financial affairs of the state, was made, in 1843, by J. W. Hammond, at one time chief clerk in the auditor general's office. The tables found therein applicable to the present purpose have been extended from 1843 to 1858, and they, together with other results incident to the financial operations of the works, have been consolidated, as shown on page 286, to determine the results there set forth, and to furnish the data for determining other questions that might arise.

$5,270,397, the deduction made from cost on account of improper charges to construction as mentioned above, we get $29,741,622 as representing the total expenditures incident to the operations of the works. The interest payments on account of loans contracted between 1826 and 1858 solely for the construction of the works amounted to $43,675,034. The latter, it will be seen, exceeded the gross revenue, apart from the sum received for the sale of the works, by over $10,000,000. Moreover the figure for revenue, including the receipts of sales, exceeded the total interest payments by only $111,519.

The total outgo to the state on account of the internal improvements, including cost, expenditures, and interest, up to the time of their sale was $101,611,234. Deducting the gross income to the treasury during the same period plus the amount received from their sale, viz.—$43,786,553, it appears that the total financial loss to the state on account of the public works was $57,824,681, to say nothing of a debt of $40,000,000* which remained unpaid at the time of the sale, and which was incurred largely for the construction of transportation improvements.†

Chapter V.—Corrupt Practises connected with the Building and Operation of the Public Works.

It has already been shown that the Act of April 9th, 1827, marks the commencement of the policy of expanding the state works; also that this legislation was the direct result of log-rolling. This form of corruption thus imprinted upon the improvement system early in its history was not easily removed. It continued to be practiced from time to time until, owing to financial embarrassment, the building of more works was made impossible. Nor was this the only corrupt influence to pervade the public works. Others soon appeared in connection with their building and operation and extended into nearly every field it was possible to reach. Before entering upon a consideration of the latter, however, it seems necessary to mention a particular instance of corrupt legislation which differed materially from the ordinary. The case in question is

* At the end of the fiscal year 1843, the state debt was $39,240,461.40 (see p. 222). Between 1844 and 1858 it remained at approximately $40,000,000.

† See Report of the Auditor General in Exec. Docs., 1844, p. 40. As already indicated in a footnote, p. 222, the debt contracted solely for the public works on January 6th, 1842, amounted to $33,359,313.

that of the Gettysburg Extension railroad, a work undertaken almost exclusively for the advantage of a single individual, whereas other works of doubtful utility were provided for in order to satisfy sectional interests.*

A very prominent and influential friend and political supporter of the governor of the state, who also at one time was a member of the lower house of the legislature, owned valuable iron mines in Franklin and Adams counties. To facilitate their development, he conceived the idea of having a branch of the public works extended through his property to connect with the Baltimore and Ohio railroad. Having been appointed to the office of canal commissioner early in 1838, he was made president of the canal board on May 17th, of the same year. In this influential position, he was able to secure legislative sanction to employ the funds of the state to commence the Gettysburg Extension railroad.† Fortunately a change of administration occurred before much work had been done, but not, however, until $682,846 had been squandered.

The circumstances in the above case were, on their face, so questionable that a committee of the house of representatives was appointed to make an investigation of the matter. After making a thorough examination of all the facts the committee reported:—"Of all the works of doubtful expediency constructed by the state, in the opinion of your committee, there is none so useless, so expensive, or of so little value as the Gettysburg railroad. It was commenced by fraud and intrigue, and will end in disgrace and loss to the commonwealth. The means of the commonwealth are inade-

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* Deception seems to have been employed in submitting the cost of certain contemplated improvements to the legislature. A "Grand Committee" appointed by the house to investigate the internal improvement system reported, in part, as follows: "From the deception that was practiced upon the people at the commencement of the system, the great excess of the actual expenditures over the original estimates, from undertaking at the same time several distant and unconnected improvements of great magnitude, the committee have reason to believe that our system of internal improvement has suffered in public estimation. It has been proved to the committee, that the estimate of the cost of at least one branch of our canal improvement, made by the engineer, was by him reduced to one-half the amount ascertained by his calculations, because, as was alleged, the work never would be authorized, if the true estimate was made known to the legislature."—J. H. Rep., 1832-33, II, p. 749.

† See Wilson, Hist. of the Pennsylvania Railroad Co., I, pp. 385-389, for a full account of the case.

quate to its completion, and if completed it could never be productive of general benefit. . . . The committee express their belief that a total abandonment of this work involves the least sacrifice of public funds the state can make upon it."*

The following year the canal commissioners endorsed the above report. They regarded the money already expended upon the branch in question as literally thrown away. Further they concurred in the general belief that the work ought not to have been undertaken, also that, if it were completed, the road would be a source of continual expense and entirely worthless to the state. Accordingly, by an Act of Legislature approved on February 19th, 1839, provision was made for its abandonment.†

Proceeding now with the consideration of corrupt practices other than those connected with the procuring of legislation, attention will be given first to the matter of "letting" contracts for building the works. Here the canal commissioners found a wide field for partisan favoritism and political corruption. Some interesting information in these particulars is given in the report of a committee appointed to look into these matters, and submitted to the legislature on June 15th, 1839.‡ A state election campaign had been in progress during the period investigated by the committee. The two candidates for governor were Joseph Ritner, a representative of the political party then in power, and David R. Porter. A court of inquiry was held by the committee and some startling disclosures were made. Although the main facts brought to light at this time were confirmed by several witnesses, the most important one was James Bradley. The latter had been the principal assistant engineer on the Wiconisco division, and, for refusing to assist in the corrupt practices of his colleagues, he was discharged. While yet in the service of the state, he had attended a letting of contracts at Halifax on the 8th of August, 1838. All the canal commissioners were present. Before the court of inquiry, Mr. Bradley testified that at the above letting one of the commissioners said that the bids of the "Porter men" should be "sent endways"; that certain bids to be considered later were laid on the table, while others were thrown on the floor. Furthermore, he

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* J. H. Rep., 1838-39, II, Part II, pp. 16-18.

† J. H. Rep., 1840, II (Appendix), p. 43; and Wilson, History of the Pennsylvania Railroad Co., I, p. 389.

‡ See J. H. Rep., 1838-39, II, Part II, pp. 4, 5, et seq.

learned at this time, from the conversation of the members of the canal board, that the rejected bids were those of "Porter men," and that they were thrown out on that account. Other evidence taken by the court revealed practices equally as culpable. For example, when a person unknown to the canal board had made a bid for a certain section of work at a fair price, the superintendent was instructed to inquire into his "moral character or religious principles." This meant nothing more nor less than the determination of his politics. If the person in question were found to be a supporter of the political party in power, his bid would be considered favorably, otherwise it was likely to be rejected. Moreover, it happened sometimes that, in case the commissioners desired to award certain contracts to their political friends who had bid too high, their papers were sent back for alteration. In one instance, it was proved beyond question that the commissioners themselves altered the figures in a certain bid without consulting the party who made it.

As a result of all the evidence taken by the court of inquiry, the committee reported:—*

"From this inquiry into the religious principles or political character of bidders, and declaration that their own friends alone were to have work, it would be fair to infer that some improper purpose was to be accomplished. But it is not left to inference,—Mr. Bradley and other witnesses clearly proved the object. The former testified that about two weeks previous to the inspector's election, Mr. Rutherford, the superintendent, received a letter from Mr. Stevens;† that Mr. Rutherford after having read the letter himself handed it to him [Mr. Bradley] to read; that it contained instructions in regard to conducting the election at Halifax; that it stated five hundred men ought to be on the works by the time of the election; and that he must be careful to have 'no Porter bosses' on the line; that the contractors must bring their men up to the polls and see that they deposited their ballots; and that he well recollected this expression in the letter—*take care of the missionary fund.*

"On the 28th of September, the day of the inspector's election, Mr. Bradley testified that Mr. Rutherford, the superintendent, brought to him the subscription to the missionary fund, signed by eighteen contractors, and the sum subscribed was $1,240. The writing to which the contractors subscribed was of the following import: 'We the undersigned agree to pay John P. Rutherford the sums set opposite our names for the purpose of diffusing useful knowledge

* See J. H. Rep., 1838-39, II, Part II, p. 5.

† Mr. Stevens was a canal commissioner.

among the people.' Mr. Rutherford stated to Mr. Bradley that this was the missionary fund; that it was to pay for handbills, circulars, etc.; that each contractor was to subscribe a sum equal to one per cent. upon the amount of his contract; and that he [the engineer] was to allow it in the estimate, i.e., allow so much more than the amount of their work, and that this was the only way they could get at the state treasury. Mr. Bradley refused to add this amount to the estimates and was discharged.

"Mr. N. F. Jones, who was a rodman on the canal, confirmed the statement of Mr. Bradley in relation to the receipt of the letter from Mr. Stevens to Mr. Rutherford; saw the subscription to the 'missionary fund' in the hands of Rutherford; heard him say that that was the only way they could get at the *big purse*; and that a larger sum than was then subscribed to the paper had already gone into Berks county. James M. Foster was present at a meeting of the contractors, which Rutherford attended. The object of the meeting was to obtain more men on the canal, and to raise money. The men were to be obtained in the county of Philadelphia,—Porter men; they were to be brought up and then made to vote for Ritner."

In the matter of "re-letting" contracts, also, the canal commissioners from time to time were found guilty of illegal and fraudulent practices. The law required:— "In all cases where a contract on the canal or railroad shall be abandoned, it shall be the duty of the superintendent or acting canal commissioner to give at least two weeks public notice of re-letting the same."* This law was violated at times, however, when the canal board in the re-letting desired to favor their political friends. How this was done is shown in the following extract† from the minutes of the board of canal commissioners, May 21st, 1839, who were investigating the conduct of their predecessors:—

"It conclusively appears to the board, that, on the 24th day of October last, a notice was published in the borough of Wilkes-Barré, of which the following is a copy:—

CANAL OFFICE, TUNKHANNOCK,
OCTOBER 16, 1838.

CANAL LETTING

Section 132, on the Tunkhannock line of the Pennsylvania Canal, and all other abandoned sections on said line, will be re-let at Tunkhannock, on Wednesday, the 7th day of November next. Specifications of the work may be seen at the canal office in Tunkhannock, on the day of letting.

E. HARDING, JR., SUP'T.

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* Laws of Pennsylvania, 1828-29, p. 255.

† See J. H. Rep., 1838-39, III, pp. 697-8. This is also confirmed by the report of a committee appointed to investigate the conduct of that same board of canal commissioners read in the House of Representatives on June 15th, 1838, and found in J. H. Rep., 1838-39, II, Part II, pp. 7-9.

That on the said 7th day of November, sections 65, 67, 98, 108, 110, 111, 112, 113, 114, 132, 133, 147, 149, 155, 159, and 174 on the said Tunkhannock line, were re-let under the foregoing notice. That none of the said sections were specified in the notice published except No. 132, and that no notice of their abandonment, or that they were to be re-let, was ever published in any form whatever, until late in the day on which they were to be allotted. That all of the said sections were re-let to the very identical persons who had abandoned them, and who had upon the same, large forces of hands employed, who were neither discharged nor stopped in their operations for a single day, insomuch, that from ought that appeared, either from the operations on the jobs themselves, or from any public notice which had been given, the citizens of this commonwealth had no reason to suppose that said contracts either had been, or would be abandoned and re-let, until the very hour when bids for them were to be received. * . . . From the above statements it conclusively appears that the foregoing sixteen sections were re-let at the enormous advance of $103,336.18† above the price at which they were bid for by men equally, if not more responsible, than those to whom the work was re-allotted."

This gross violation of the law governing the re-letting of contracts becomes all the more culpable since the contracts were re-assigned at a considerable advance in price to the very persons who had not abandoned the work of construction under the original arrangements. As to whether the contractors alone were to profit by the deal, or whether a part of the differences between the old and the new prices was to be refunded to the higher officials or be used for campaign funds, does not appear in the evidence. The fact remains, however, that by such practices the state was robbed and the debt correspondingly increased.

It is of course impossible to make any estimate of the extent to which the state debt was augmented on account of political favoritism. The inference is, however, that the increase was considerable. A committee appointed on the 18th of January, 1841,‡ to investigate the expenditures upon the canals and railroads belonging to

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* Here follows a tabular statement of the names of the contractors who abandoned and retook the same contracts; the prices under the former contracts; the prices under the new contracts; the names of the competent and responsible bidders; and the amounts which they bid.

† The combined prices of the first letting on these sections was $339,535.62. The advance in price at the re-letting was $93,770.63 above this figure, or $103,336.18 above the price of the rejected bids.

‡ See J. H. Rep., 1841, II, p. 591.

the state brought to light some interesting information concerning this point. The period examined extended from the middle of the year 1839 to the end of 1840. The evidence taken, which, in the opinion of the committee, unearthed only a small proportion of the abuses actually existing, revealed, in the few cases examined, the following:—*

That the state lost through the superintendent of motive power on the Philadelphia and Columbia Railroad not less than	$ 6,000
That the construction of a certain division of railway track cost the public more than it would have cost, had the contracts been given out fairly to the lowest good bidders, not less than	18,000
That through favoritism the supervisors of the Juniata division of the canal had exceeded the necessary expenditures not less than	6,000
That the allotment of the contract for the Eastern reservoir was at a price above those tendered by good bidders, not less than	20,000
That the allotment of the contract for the Western reservoir was at a price above those submitted by good contractors, not less than	30,000
That the price allowed for clearing 400 acres of land for the latter was more than the work was worth, not less than	10,000
That in the allotment of lock 13 on the Western division of the canal there was allowed more than was necessary, not less than	1,200
That in the case of two other locks specified there was allowed more than was bid by good contractors, not less than	10,000
That in the allotment of nine sections of canal on the Conneaut line of the Erie Extension there was more allowed than the average bids of good contractors, not less than	35,000
That in the allotment of contracts for 16 locks in 1839 a loss was entailed to the state from failure to consider the bids of political opponents, not less than	33,000
Total	$169,200

Commenting upon their findings, of which the above is merely an abstract, the committee stated:—"Our inquiries have been confined to a small portion, when compared with the whole of the public improvements of the state, and the result of those inquiries cannot fail to startle and astonish. We find that within the period of a single year, by the policy and practices which have prevailed, the public money, to a large amount, has been squandered and improperly paid away. We leave for further inquiry and development many transactions of a character as suspicious as any that have been examined, and it is not surprising that under such management,

* See Report of Committee in J. H. Rep., 1841, II, p. 588.

the revenue arising from the finished lines of the public works should fall short, as it did last year, about $350,000 of the sum expended in their repairs and superintendence, and that their further prosecution should be viewed with alarm by the warmest advocates of internal improvements by the commonwealth."*

The report of another committee appointed by the legislature to investigate the conduct of the canal commissioners and their agents and read in the house of representatives, April 7th, 1834,† contains evidence of corruption different from any yet mentioned. It was proved to the committee during their inquiry that there was "an utter destitution of moral principles in the supervision of the Susquehanna division, and that the most fraudulent and criminal practices against the commonwealth were carried on by one who, at the very time of his disregard of every suggestion of honesty and prompting of duty, was a judge of Northumberland county." The person in question was a supervisor on the above-mentioned division. According to the evidence which was taken during the investigation, he gave script to a certain laborer for the amount of his wages. The workman was told that this paper would be discounted at the Middletown bank. To cover the amount of the discount, the supervisor directed the laborer to add eight or nine days to the check roll which was presented to the auditor general. This was done and the state was defrauded to this amount. Moreover, there were brought forward and sworn to books containing accounts of the number of days each laborer had worked on the canal. From these and other records it appeared that one sum was paid to the workmen and another charged to the state. This was proved by an examination of the auditor general's report. In this way the supervisor padded the accounts of a single foreman to the amount of $381.

On the Delaware division, the abuses were somewhat different. It was shown to be the practice of a certain supervisor to take state laborers and set them to work on his private property. The time they were thus occupied was included in the pay roll handed in to the auditor general. In a single month the amount of money paid out by a contractor guilty of this practice was $857.88 for work actually done on the public works. During the same period the

* J. H. Rep., 1841, II, p. 589.

† See J. H. Rep., 1833-34, II, pp. 887, 888, et seq.

extra amount charged to the state for work done by state laborers upon his own property was $137.07½.*

Investigations made at the same time concerning the building of other sections of the transportation system unearthed abuses of still another kind. Thus, on the Wyoming division, where work had recently been suspended for lack of funds, it was proved that a claim was allowed for 400 rods of stone at ninety cents per rod, whereas the actual measurement was found to be 81 rods. In other cases allowances were made for 460 and 936 rods, although the respective measurements were only 183 and 301 rods.

It also seems clear that, in many cases, the work executed by contractors was badly done. This is shown by the fact that no sooner had the public improvements come into operation than liberal appropriations had to be made at almost every session of the legislature to keep them in a condition suitable for use. Doubtless it is true that a considerable amount of the imperfect construction should be attributed to the lack of experience in building canals and railways; also to other causes beyond the control of the contractors. Nevertheless the evidence is conclusive that the anxiety of the contractors to swell the amount of their profits at the public expense often was the direct cause of defective work. The canal commissioners themselves occasionally made admissions to this effect,† and to this the testimonies of various contemporary writers could be added. Notwithstanding liberal yearly expenditures for repairs, the canal board, in 1839, asked for the sum of $1,125,760 for this purpose. The request was made in accordance with the estimate furnished by their engineer, who pointed out the dilapidated condition of certain sections on almost every division of the public works.

In filling positions in connection with the operation of the canals and railroads much political favoritism was shown. In 1837 and again in 1838 "select committees" were appointed by the house of representatives to see if there was any ground for the numerous

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* See J. H. Rep., 1833-34, II, p. 899.

† See J. H. Rep., 1830-31, II, p. 160; 1833-34, III, p. 8; 1840, II, pp, 4-5, and III, p. 17.

Solomon W. Roberts, who was employed on the state works as a civil engineer while they were being built, said regarding the canals: "Much of the work was badly done, and was not strong enough to withstand the occasional floods to which it was exposed."—Pennsylvania Hist. Mag., II, p. 371.

complaints. As a result of the inquiry it was found* that frequently engineers on locomotives and stationary engines of the Philadelphia and Columbia railroad were discharged to make way for others. The latter, it was found, often knew little or nothing about the practical operation of the engines placed under their charge.† "In some cases the engineers were so totally ignorant of the duties of their offices as to be obliged to learn them from their firemen and subordinates." The committee endeavored to seek out the cause for such practices on the part of the canal commissioners. The evidence prompted them to report that such removals and appointments had been made in many instances on political grounds alone.

Referring to the main line of canal, the committee stated: "Instances of extravagance, neglect, and incompetency on the part of those to whom this important line was entrusted have been proved, as well as a disposition to favor certain individuals, altogether incompatible with the public interest. Amongst other evidence of the incapacity of agents proved to the satisfaction of the committee, they would name that a supervisor was sent to the Juniata division who knew so little about a canal that he could not tell the difference between an aqueduct and a culvert."

The method of accounting practiced by the canal commissioners is, in some respects, open to adverse criticism. Whether or not the system used was devised for the purpose of misleading the public, the fact is that it did. Before continuing the discussion of those corrupt practices, which more properly fall within the scope of this chapter, an examination will be made of some of the questionable features in the accounting system of the canal boards.

The cost of the several portions of the main line of works when completed, equipped and brought into use was as follows:—

Philadelphia and Columbia railroad (report of 1836)	$3,330,127.55
Eastern division of canal (report of 1836)	1,347,014.40
Juniata division (report of 1830)	3,036,290.13½
Portage railroad (report of 1836)	1,634,357.69
Western division (report of 1830, which included extensive repairs)	2,758,917.71
Total	$12,106,707.48½

* See J. H. Rep., 1836-37, II, pp. 801, 802, et seq. for the report of a select committee relative to the management of the canals and railways of the commonwealth.

† In the report of the canal commissioners for 1839 it was stated that out of twenty-seven engines on the Philadelphia and Columbia railroad, the new administration found only five that were fit for use. This was due, to a large extent, to the drivers not knowing how to keep the engines in repair.

The cost of the same sections at the time of their sale, as shown by the reports of the auditor general and state treasurer, was as follows:—

Philadelphia and Columbia railroad	$5,277,278.00
Eastern division of canal	1,737,285.00
Juniata division	3,575,966.00
Portage railroad	2,708,672.00
Western division	3,173,434.00
Total	$16,472,635.00

From the above it appears that there was added to the cost of the main line after its completion the sum of $4,365,927.51½. Similarly, a detailed statement of the original and final cost of the lateral works (see page 284) shows an increase of the latter over the former of $904,468.66. In both cases, this increase admits of explanation. The expenditures were divided into two classes, ordinary and extraordinary. The former included only such items as were clearly chargeable to the current yearly expenses and represent the "expenditures" shown in the tabular statement in Appendix VI. The appropriations for repairing breaches, damages by floods, renewals of locks and dams, and numerous other items were placed in the extraordinary list and added to the original cost of the works. By this means the cost of the main line and lateral branches by the time of their sale had increased, as we have seen, $4,365,927.51½ and $904,468.66 respectively.

Another feature of the accounting system of the canal commissioners resulted in suppressing the whole truth regarding the cost of, and expenditures upon, the various sections of the works. Their own expenses, those of the boards of appraisers, the salaries of collectors, weighmasters, and lock-keepers, and the cost of the various exploratory surveys did not appear in their financial reports. Consequently all such statements which showed the yearly profits obtained in operating any section were made just as if no expense had been incurred for any or all of the above items. Yet, from 1826 to 1858, they amounted to about two and one quarter millions of dollars.

In order to illustrate the way in which the accounting of the canal commissioners misrepresented the actual financial conditions of the public works, a comparison will now be made of their

accounts and those of the auditor general of the state for the year 1856.* The latter reported the expenses of all the public works as follows:—

Expenses	$1,943,896.82
Damages paid	52,281.21
Old debts paid	130,512.09
Total	$2,126,690.12
The canal commissioners returned the total expenses at	1,076,685.14
Difference between the two statements	$1,050,004.98

During the same year, the expenses of the main line alone, excluding the amount charged to construction account, were, according to the auditor general, $1,212,536.80. The canal commissioners reported them to have been $840,377.03, a difference of $372,159.77. Again, the canal board represented that, in 1856, the net profits of the main line were $382,596.42. If, however, we take into consideration all the ordinary disbursements including those referred to on page 239, the net profits are reduced to $10,436.75. But in order to leave as a balance even this amount, it is necessary to omit the following expenses connected with the main line in 1856:— $268,396.76 for a new track for the Philadelphia and Columbia railroad; $181,496.74 on the New Portage railroad; and the interest on $16,472,634.15, which was the cost of the main line to this date.

The results shown in 1856 by the canal commissioners in their system of accounting were, doubtless, no more misleading than they were in any other year that might have been chosen. Consequently it seems but fair to say that the continued practice of this method of accounting, which so effectively concealed the unsound financial conditions of the public works, lays the various boards of canal commissioners open to adverse criticism of no mild nature.

It would extend this chapter much beyond its appropriate bounds to detail all of the ways in which unscrupulous employees on the public works betrayed the trusts of their offices. However, a summary of abuses other than those already mentioned, some of which seem to have been perpetrated time and time again, will suffice to show that no possible chance to defraud the public seems to have been overlooked. Positive proof was obtained to substan-

* See Letters on the Sale of the Main Line, pp. 10-12.

tiate the following charges of attempts to defraud the commonwealth:—*

1. That time was charged for work that was not performed.
2. That teams were charged in the name of persons who had no teams on the work, and, in some instances, the amount of the charge was receipted for without the knowledge or consent of the person in whose name the account was kept.
3. That teams were charged at full or high prices, although the driver's time was charged in a separate account.
4. That public teams were freely donated for the use of private individuals and political partisans, and that their time on such occasions was charged on the check-roll.
5. That at certain times a large amount of money was expended for getting hands on the works to replace those who had been discharged "for opinion's sake."
6. That extra time was added to the check-rolls, at the will of those having charge, to cover the expense of bringing hands from a distance, although large amounts were returned by bill for the same service.
7. That time was continued for hands and teams after they had left the works.
8. That articles never purchased for the works, nor used on them, were charged up to the state.
9. That many persons were induced to receipt for money which they never received, and to which they had no claims.
10. That bribery was attempted for the purpose of procuring the public funds, and actually took place to secure favorable legislation.
11. That lumber and other articles were purchased to be delivered on the line of works at a given place and at a fixed price. The contractor, however, charged the commonwealth with the daily pay of the teams employed to deliver the goods. Furthermore in one case, at least, the charge for a teamster was $2 per day more than the teamster received, notwithstanding the fact that the bill therefor was paid largely out of the contractor's store.
12. That officers and workmen received pay and travelling expenses while in other parts of the state attending elections.
13. That many persons were hired at high salaries who were neither foremen nor skilled mechanics.
14. That foremen and others, while engaged in the public service, bought and slaughtered cattle, using the state teams and laborers when they so desired, and supplied the line with meat at a high price.

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* See J. H. Rep., 1840, II, pp. 234-5, which contains a report of fraudulent accounts submitted to the auditor general. See also J. H. Rep., 1841, II, p. 547.

15. That provisions were charged to the commonwealth at a figure much in advance of the prices current in the markets.

16. That for months one of the supervisors charged the state for the services of three yoke of oxen at $12 per day, exclusive of the driver, although it was shown that he had but two yoke; that for weeks in succession but one yoke of oxen was engaged on the works; that $6.25 a day was charged by the same person for a two-horse team and driver, which were employed for the greater part of the time in his private use.

17. That a large amount of whiskey was charged to the commonwealth.

18. That blank check-rolls furnished by the state for the keeping of accounts were often mutilated. Headings and certificates were cut off and others attached by wafers leaving it uncertain in what condition the papers were when sworn to, and, in the words of the auditor general, "whether teams at $6 or $8 were not substituted for hands at 95 cents per day, or whether one individual may not have signed for others."

19. That allowances were made by the canal commissioners for damages, the claims for which had already been settled in full and releases executed therefor and filed in the auditor general's office.*

20. That the expenditures for wood alone in the engines on the state railways rose from $19,217.50 and $26,174.78 in 1850 and 1851 respectively to $107,255.28 and $108,643.17 during the two following years, with no explanation for the increased expenditure.†

Before concluding, it seems in order briefly to quote the opinions of certain persons intimately acquainted with the management of the public works regarding some general aspects of the questions discussed in this chapter. A select committee of the senate, in reporting upon various matters concerning the state improvements in 1854, summarized the case regarding corruption as follows:—

"The officials and agents of the system, whose name is legion, extend to all parts of the commonwealth,—a vast engine of polit-

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* See J. H. Rep., 1838-39, II, part II, pp. 11-14. Here is recorded the case of J. Andrew Shulze, who on January 2d, 1835, received $700 as damages and on September 17th, 1838, he was again allowed $1,500 for practically the same damages for which the $700 was "a full indemnification." This was brought out in an investigation made by a committee appointed by the House of Representatives to inquire into the conduct of the canal commissioners.

† The conclusion arrived at by a commission appointed to examine the affairs of the main line was that the frauds practiced in 1852 and 1853 were excessive, although the investigation failed to bring to light the perpetrators of the acts.

ical power, unknown to the constitution, moved by common impulse, and operating upon the public mind at any time they are so disposed, in state conventions and at the ballot box, in solid column, and with almost irresistible sway. But it is not as a dangerous political machine that it is viewed in its worst aspects, nor as an exhausting drain upon the public purse; its malign influences upon the morals of the community are even more to be dreaded than all other evils, and powerfully coöperate to make it a festering disease upon the public. At every stage, complaints have been made of the extravagance, fraud, and speculation in the conduct of the works, and the most honorable agents have been stigmatized with odium by an indignant public, smarting under the known abuses and heavy burthens they have generated. Attempts to reform, however loudly professed and honestly made, have been unavailing to eradicate evils inherent in the system. . . . That practices at war with the established systems of political economy have resulted in debt, taxation, extravagance, mortification and disappointment is a misfortune. Had the object of this anomalous system been to destroy and not to build up the revenues and the morals of the state, it could not have been more ingeniously devised."*

Again, William Bender Wilson, in his "History of the Pennsylvania Railroad Company," in speaking of the public works, said:—†

. . . "Millions of wealth were squandered in construction, the public were punished or rewarded as they denounced or sided with those in position, employees were plundered by so-called assessments, and the ballot-box polluted for the purpose of perpetuating power. All the avenues of government were completely corrupted,

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* Report upon the Public Works of a Select Committee—read in the Senate, February 4th, 1854, and found in Legislative Documents, 1854, p. 329.

A pamphlet published at Philadelphia in 1857 consisting of a series of letters originally published in the Philadelphia Evening Bulletin advocating the sale of the main line contained, page 47, the following: "A well managed commonwealth never corrupts her children. Yet on Pennsylvania's public improvements thousands of employees have wrecked their characters, and hundreds of her most promising sons have had sad and real reason to curse the day they ever learned that Pennsylvania had a line of railroad or canal on which to seduce to crime. Under the necessarily loose and irresponsible mode of transacting business upon these works, this evil has been, and is being done. While the works remain in her hands, they will be the home of partisans and swindlers who will ruin themselves, disgrace the state, and spread a moral desolation among the people. Change of administration does not cure the evil. It is inherent in the thing, and will be manifested while human nature remains as prone to evil as at present."

† Vol. I, p. 40.

state credit collapsed, and the public improvements of Pennsylvania became public scandal. . . . It was not an infrequent occurrence on election day to see the gravel train loaded down with men moving from town to town with the scarcely disguised intention of polluting the ballot-box—repeating at the polls became the rule along the line, and waiting in expectation for the gravel train to come in was the occupation on election day of the local adherent of the railroad boss. Personally, I have seen the paymaster, after requiring the employee to sign the pay-roll for the full amount of his pay, count out the amount, less ten per cent., and without a word of comment unblushingly take the latter and put it in a bag made for the purpose, and labelled 'Political Assessments.' The public service became gorged with the friends and adherents of those in power, whose principal duty seemed to be to sign the pay-rolls, submit to assessments and vote the ticket handed to them."

In spite of the widespread operation of fraudulent and corrupt practices, as shown above, it should be added that these charges, by no means, applied to the employees on the state works *in toto*. On the contrary, there is every reason to believe that scores of honest and efficient officials discharged their duties in a manner highly creditable both to themselves and to their country. In fact, the findings of committees appointed to investigate charges of corruption on the part of certain state officials exonerated beyond question various employees who had been placed under the ban of suspicion by disappointed office-seekers. Again it may be said that, granting the widespread operation of corruption that existed under state ownership and control, we have no assurance that there would have been any greater purity under corporate management. However this might have been, the case seems perfectly clear that, throughout the greater part of their history, the public works were used by the political party in power as an invaluable instrument of political corruption, destroying the morals of citizens and squandering the resources of the state. Consequently, those who are abashed by the present-day disclosures of corruption in the management of cities and powerful corporations, and who therefore sigh for the "good old days" of political purity, have to face the fact that these did not exist in Pennsylvania at least during the period of state ownership and control of the public works. Nor can the advocates of the extension of state enterprise into various fields of activity at present considered dangerously corruptible find much to substantiate their views by an examination of the same period.

Chapter VI.—The Disposal of the Public Works.

The movement for the withdrawal of the state from the ownership and operation of the public works originated during the years of financial embarrassment between 1839 and 1844. At this time numerous arguments were brought forward in the press, in pamphlets and in petitions showing why the divorce of the state from the transportation system was desirable. In attempting to arrive at the causes for such a complete change of public sentiment one finds a variety of influences appearing. The utter financial failure of the improvements has already been fully discussed. This was one of the strongest contributing factors to the movement under consideration; for at this time the financial difficulties were attributed largely to the squandering of money upon works which were neither yielding nor could be expected to yield a respectable revenue. Again, bad management and corruption combined to make the improvement system unpopular. Moreover, there was now a gradual awakening to the fact that the only means of preserving the state's honor was heavy taxation. A sale of the public works would not only lighten this burden but also diminish the debt and assure the public that the latter would not be further increased.

These considerations, detrimental to the popularity of the transportation system even in times of commercial expansion, became increasingly so as the public mind became depressed. Pennsylvania, in common with the rest of the country, was laboring under one of those financial convulsions which sometimes overtake communities and prostrate the energies of the strongest. Under such conditions it seems natural that, for the reasons already mentioned, a large party should be desirous of relinquishing the improvement system. But still another factor which considerably influenced the movement should not be overlooked. This was the growing consciousness that the main line in particular had failed to accomplish its purpose—that it could not compete successfully with the Erie canal for the trade of the West. This point now requires some attention before the movement itself is discussed.

The trunk line of Pennsylvania's public works was opened in 1834 to compete for a trade which for nine years had been practically monopolized by the Erie canal. Again, a large proportion of the most important public improvements of the northwest were

built so as to connect with this line.* It should be mentioned, however, that not long after the main line of Pennsylvania's public works was completed it was connected with the Ohio and Erie canal.† Thus two routes to the tide-waters of the East were available for the shippers along the Ohio and Erie canal and its branches. Although the route to Philadelphia via Pittsburg and Pennsylvania's public works was from 200 to 300 miles shorter than to New York via Lake Erie and the Erie canal, yet most of the traffic going East took the latter route, which was much easier and cheaper than the former.‡ The advantage in distance gained by going through Pennsylvania was more than offset by the broken character of the transportation line.§ For through freight had to be transshipped to overtop the Allegheny mountain, again at Hollidaysburg,

* In 1832 the State of Ohio opened through her own territory two lines of canals,—one from Portsmouth on the Ohio river to Cleveland, the other from Cincinnati to Toledo. Of the products of the country adjacent to these canals it may be said, in general, that breadstuffs sought their outlet through the Erie canal, while provisions of all kinds went to market through New Orleans.—See Poor, Manual of the Railroads of the United States, 1881, p. xvii; and Andrews, Report on Colonial and Lake Trade, p. 234.

† The Sandy and Beaver canal connected the Ohio and Erie canal with the Ohio river and the state works of Pennsylvania at Pittsburg. The Mahoning canal also united the Pennsylvania and Ohio canals. It extended from Akron to the confluence of the Mahoning and Beaver rivers, where it met the Beaver division of the Pennsylvania canal.

‡ See Andrews, Report on Colonial and Lake Trade, pp. 240 and 262; Report of Canal Commissioners, Jan. 15th, 1842, in J. H. Rep., 1842, III, p. 42; and Hunt's Mer. Mag., XXIII, November, 1850, pp. 489 and 500.

Until 1830 or 1840 the tonnage and value of the exports from the northwest were small, the surplus products being largely consumed by the growing population. After this time the resources of the west were rapidly developed. The total number of tons of commodities arriving at tide-water from the western states via the Erie canal increased from 83,233 in 1838 to 1,213,690 in 1853.

§ "The chain which was to bind Philadelphia with the west was not continuous and unbroken, composed of intermingling and welded links, but severed, disjointed, fragmentary. It was an amphibious connection of land and water, consisting of two railways separated by canal, and of two canals separated by railway,—happily elucidating the defects peculiar to both modes of transit, with the advantages of neither. This improvement being useless as a competitor of the Erie canal, disappointed private hope in the benefits promised, and public hope in the unprofitable burden imposed. The commonwealth, oppressed by her debt, and the citizens impoverished by their losses, the western trade alienated and the foreign trade neglected and diminishing, Pennsylvania presented the reverse side of her early picture—one not

and finally from the canal boats to the cars at Columbia. The freight was handled by transportation companies which fixed the freight rates. No matter how small the business of the individual concerns might be, each had to have available both cars and boats. Moreover, five sets of depots and agents were necessary, located at Philadelphia, Columbia, Hollidaysburg, Johnstown and Pittsburg. Hence it can readily be seen that the fixed expenses of these carriers were necessarily heavy. This fact was strongly reflected in the freight rates. These were placed at such a high figure that, for through traffic, the Erie canal had a decided advantage; for, owing to the unbroken and even character of its route as compared with the main line through Pennsylvania, the transportation companies on the former line could make a fair profit at lower freight rates than those which prevailed on the latter.* Moreover, the transportation companies operating between Pittsburg and Phil-

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pleasing to contemplate, but, I presume, less painful and humiliating in the remembrance and retrospect, than in the experience and reality."—Tyson, Letters on the Resources and Commerce of Philadelphia, p. 14.

* The following statement was made by a gentleman who for a number of years was engaged extensively in transportation, both in Pennsylvania and in New York:—"The charge for transporting merchandise from New York to Albany, 160 miles on the river, by the use of steam tow boats, is about the same as for 20 miles of canal.

"The distance from Philadelphia to Pittsburg (399 miles by main line) is equal to 600 miles of canal. To keep up a daily line of freight boats, there is a dead loss of about $15,000 when compared with the Erie canal of New York. The agency and storeroom at Philadelphia, Columbia, Hollidaysburg, Johnstown and Pittsburg cost about $20,000, while these expenses on the New York canal do not exceed $5,000."—J. H. Rep., 1838-39, III, p. 514.

Another transporter who owned one of the important lines stated:—"At a living profit we find that we can carry 100 pounds 100 miles for 25 cents on the canal, for 50 cents on the railroad, and for $1.00 on the turnpike roads. This is the result of five years heavy business in the three modes of conveyance. The three trans-shipments, viz.—at Columbia, Hollidaysburg, and Johnstown, equal the expenses of 50 miles of canal. Our line averaging one and one-half boats per day, say 4,000 tons westward and 3,500 eastward, costs for agency and storeroom at Philadelphia, $8,000; at Columbia, Hollidaysburg and Johnstown, $3,000 each; and at Pittsburg, $7,000; total $24,000. Equivalent distance from Philadelphia to Pittsburg, 562 miles."—J. H. Rep., 1838-39, III, p. 518.

"The question is not whether the Juniata or the West Branch shall carry the trade, but whether we shall secure the transportation by furnishing a cheaper and a better route, or whether the extra expense and difficulties of the present line shall be allowed to drive the trade out of the state. . . .

adelphia frequently entered into agreements to charge excessively high rates during the first few weeks of the season before the Erie canal was open. This policy resulted in a somewhat general avoidance of this route for through traffic when other lines became accessible.

Hence the main line of Pennsylvania's transportation system failed to secure the trade of the West. This fact was freely admitted by the canal commissioners, legislators and others.* It would be an interesting matter, however, to compare in tonnage and value the movement of commodities upon the Erie and Pennsylvania canals from the West to tide-water and *vice versa*. Unfortunately this cannot be done with any degree of accuracy; for the returns of the latter line as contained in the reports of the canal commissioners do not furnish the necessary data. Owing to the lack of classification, it is not possible to distinguish the local from the through tonnage or the quantity or value of the commodities received from and going to other states as shown by the reports of traffic on the Erie canal. The returns show only a small movement eastward over the Portage railroad. Probably this indicates fairly correctly the through movement. The westbound traffic passing over the same railroad was larger both in tonnage and value†—the opposite of what was anticipated when the main line was being built.

The principal causes which gave rise to the popular movement for the disposal of the state works having now been considered, attention

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By the present interrupted communication there is great irregularity as to time. The machinery is too complicated for an extensive trade. Articles that belong to the same individual become divided, sometimes damaged by the frequent changes, sometimes lost. There is a rigidity in the system that does not admit of changing according to the changes of trade with the season."—From report of B. Ayerigg, Civil Engineer, made to the legislature, in J. H. Rep., 1838-9, III, p. 523.

* See Baker, Relative Commercial Progress of New York and Philadelphia, p. 23; Tyson, Letters on the Resources and Commerce of Philadelphia, p. 14; Hunt's Mer. Mag., XXV, 1856, p. 149; J. H. Rep., 1842, III, p. 42.

† About 30,000 tons of various kinds of commercial commodities were taken over the Allegheny mountains in wagons annually from 1818 to 1824. Though it is not definitely stated in the reference it suggests that this figure represented the tonnage going westward.—See J. H. Rep., 1824-25, II, p. 280.

In 1836 the westbound freight carried over the Portage railroad was 29,740 tons, while passing eastward the amount was 15,439 tons. The total freight going east and west, weighed at Hollidaysburg, was, in 1844, 65,876 tons: in 1845, 83,972 tons; in 1854, 73,000 tons. The movement from the western states to tide-water by the Erie canal during the same years was in 1836,

will be directed to the movement itself. The actual result of the public sentiment was that the legislature at once undertook to dispose of the state works. The Erie extension soon passed into private hands, and that too without any monetary consideration. The transfer was provided for by "An Act to incorporate the Erie Canal Company," approved on the 7th of March, 1843. It was authorized that, upon the granting of letters patent to this company,* the uncompleted canal from Erie to the mouth of Beaver river on the Ohio, also the French Creek feeder, should be vested in the new corporation. It was further provided among other things that the Beaver division, which extended from Newcastle to the Ohio river, should not be surrendered until the line from Newcastle to Erie was completed and in actual use throughout its whole length. Accordingly the company undertook immediately the work of completion. Upwards of $575,000 were expended in repairs, renewals and extensions.† On December 2d, 1844, a boat was passed through the outlet lock into the basin at Erie after traversing the entire length of the canal from the Ohio river. The terms of the act of incorporation having thus been fully complied with, the Beaver division was officially surrendered to the company on January 1st, 1845.‡ Apparently the transfer was not opposed by any persons excepting the canal commissioners.§

54,219 tons; in 1844, 308,025 tons; in 1845, 304,551 tons; in 1854, 1,100,526 tons. The amount of merchandise which went to the western states over the Erie canal was in 1837, 38,893 tons; in 1844, 37,335 tons; in 1845, 42,415 tons; in 1854, 261,752 tons.

For a complete classified movement of east and west tonnage on the Erie Canal see Poor, Manual of the Railroads of the United States, 1881, p. xv.

* The Erie Canal Company was capitalized at $500,000. There were to be 10,000 shares having a par value of $50 each. It was provided that 1,000 shares should be subscribed and paid for before letters patent should be issued by the governor to the company.

† See the company's reports in J. H. Rep., 1844 and 1845, II, pp. 119 and 231 respectively.

‡ When the rest of the public works were disposed of the Erie Canal Company had paid no dividends to the stockholders. Bonds were issued in 1845. The interest payments were very irregular. In 1859, $556,715 interest was overdue. See Poor, Railroads of the United States, I, p. 555.

§ By Act of March 13th, 1845, the Wiconisco Canal Company was incorporated to take over the unfinished works of the Wiconisco section of the state works. No monetary consideration seems to have been paid. The state had expended upon this work before the transfer was made the sum of $393,441.

Before this gratuitous disposal had been arranged, the governor of the state, by Act of July 27th, 1842, was authorized to receive bids for any or all of the various sections of the canals and railways.* An offer of $3,000,000 for the Philadelphia and Columbia railroad with all its fixtures, and of $10,000 for the outlet lock at Portsmouth were the only ones received. Neither of these bids was considered.

When the legislature met in 1844, it was clear that public sentiment regarding the works was still unchanged. Accordingly on April 29, an Act was passed† embodying a plan to dispose of the trunk line from Philadelphia to Pittsburg for $20,000,000. A company capitalized at this amount was to be incorporated to take over the works. It was to be called "The Pennsylvania Canal and Railroad Company." There were to be 200,000 shares having the par value of $100 each. Commissioners were named to sell the stocks at public auction at the Merchants' Exchange in Philadelphia. Purchasers might pay the amounts of their subscriptions either in lawful money or in state stocks.

The thirtieth section of the act provided that, at the next general election, an opportunity should be given to the qualified voters of the state to register their wishes regarding the proposition to sell the main line on the conditions mentioned above. On the 8th of October, 1844, the election was held and a majority of 25,150‡ was given for the sale. Accordingly the commissioners advertised a sale of the stock of the proposed company to commence on January 20th, 1845. No subscriptions were received at that time, however, and a continuation of the sale at subsequent dates resulted in no better success. Doubtless the high price fixed for the main line was the cause.§ That the people appreciated this fact is shown by the numerous petitions at once forwarded to the legislature, which was then in session, praying that the price be reduced to a more inviting figure. These were referred to the house committee on ways and means. The latter reported against any further legislative action at that time.‖ It was felt by the committee that the

* Laws of Pennsylvania, 1842, p. 447.

† Laws of Pennsylvania, 1844, p. 486.—"An Act to reduce the state debt and to incorporate The Pennsylvania Canal and Railroad Company."

‡ The votes stood as follows:—149,748 for the sale and 124,598 against it. See J. H. Rep., 1847, II, p. 266.

§ See J. H. Rep., 1845, II, p. 545.

‖ The report is contained in J. H. Rep., 1845, II, pp. 544-47.

price as fixed by the Act of April 29th was not too high and that to place the works in the hands of a corporation would be an exceedingly dangerous move. Accordingly the legislature, for the time being, made no further attempt to effect a sale. It is difficult to say to what extent the fear of corporate power influenced the subsidence of the popular agitation. Certainly in 1844, when a large majority was given in favor of selling the works, it was known that, in case of a sale, they must pass into the hands of a corporation. Yet it should be remembered that, on account of the recent financial embarrassment, the public mind was temporarily in a most depressed condition; and that any means by which the debt could be diminished and expenses reduced would be anxiously sought. But by the time the committee on ways and means had reported in 1845 general prosperity was returning. Moreover, the dismissal of a large number of superfluous employees on the works; the adoption of a policy of non-extension; the general practice of economy wherever possible; and a diminished amount of corruption,* all combined to allay, for the time being, the agitation for the sale. Consequently, during the next few years, this matter seems to have received but little attention.

Meanwhile another movement began to manifest itself. As a medium for competing for the trade of the West, the state works were, as has been seen, a complete failure. Various improvements, however, had now developed a method of transportation to which the Allegheny mountain should be a less formidable barrier than it had been twenty years earlier when the public works were about to be built. It seemed necessary for Pennsylvania to take advantage of these improvements and build an all-rail line to the West. For, on the north, the Erie canal, as has been seen, had secured to New York a large proportion of the commerce passing to and fro between the seaboard and the West. Also, in the south, the Baltimore and Ohio Railroad Company was threatening to divert the rest to Baltimore. In the face of these conditions, the commercial classes of Philadelphia threw themselves into the movement for the construction of a railroad to the Ohio valley.

When the legislature met at Harrisburg in January, 1846, many influential citizens of both Philadelphia and Baltimore were on hand to secure legislation favoring their respective cities. Those

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* See Exec. Docs., 1846, p. 9. of Governor's message.

from Philadelphia asked for authority to build a railroad from Harrisburg to Pittsburg. The representatives from Baltimore sought to secure a renewal of the lapsed privileges to extend the Baltimore and Ohio from Cumberland, Maryland, through Pennsylvania to Pittsburg.* The outcome was the passage of two bills—one incorporating the Pennsylvania Railroad Company by Act of April 13th, 1846;† the other, approved eight days later, granting the above-mentioned concession to the Baltimore and Ohio Railroad Company.‡ The latter, however, was subject to the following proviso:—

"That if the legislature, during its present session, should pass an act incorporating a company with authority to construct a railroad from Harrisburg to Pittsburg within the limits of this state, and $3,000,000 should be *bona fide* subscribed to the stock of the said company, and ten per cent. on each share be actually paid in, and letters patent be issued by the governor, in conformity to the provisions of said act, within one year from the passage thereof; and if thirty miles or more of said railroad should be put under contract for construction, and satisfactory evidence thereof be furnished to the governor on or before the said thirtieth day of July, 1847, then, in that case, the governor shall issue his proclamation setting forth that fact, and thereupon this act granting the right of way to the Baltimore and Ohio Railroad Company to extend their road through this state to the Ohio river at Pittsburg shall be null and void."§

The "pride and commercial necessities" of the citizens of Philadelphia were now appealed to and after some difficulty the requirements of the law were met. The Pennsylvania Railroad Company was chartered on the 25th of February, 1847, and thus the conditional privileges granted to the Baltimore and Ohio became void.

When the question of incorporating the Pennsylvania Railroad Company was under consideration, one of the strongest objections raised was that a railway line would divert business from the public works. In order to furnish the latter with adequate protection, the act of incorporation provided that a tax of five mills per ton-mile should be imposed upon all freight received at Harrisburg, Pittsburg

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* For a full discussion of the facts relating to the origin of the Pennsylvania Railroad Company see Wilson, Hist. of the Pennsylvania Railroad Company, I, pp. 1-6.

† Laws of Pennsylvania, 1846, p. 312.

‡ Laws of Pennsylvania, 1846, p. 448.

§ Laws of Pennsylvania, 1846, p. 449.

or intermediate points and carried more than twenty miles.* According to the original enactment, this tonnage tax was to be collected only during the months when the canal was being navigated, viz.—from March 10th to December 1st. By Act of March 27th, 1848, the rate was changed to three mills, to be collected throughout the whole year.† When the Pennsylvania railroad was opened for traffic, it was soon found that no injury was done to the business of the public works. Accordingly, the plea that the tonnage tax was necessary for their protection ceased to be urged, but its continuance was defended on the ground that the state needed the revenue.‡ The real competition for the trade of the West was beyond the sphere of the canal, and the Pennsylvania railroad was the only means by which the fraction of the western trade not yet diverted into other channels could be retained for Philadelphia.

The evils connected with the management of the public works which, as has been mentioned, were partially eliminated in 1844-45, soon began to reappear. This fact was brought to the attention of the legislature by Governor Johnson through his message in 1850. Moreover, investigating committees brought to light many suspected abuses. Soon the popular agitation for the sale of the improvement system was revived. In this connection the principal arguments now advanced were—the necessity of reducing the state debt so that there might be relief from high taxation; the greater efficiency and economy of management under private ownership; the excessive frauds practised upon the commonwealth; and the oft-repeated fact that, even before improvements in the methods of transportation had placed the state works out of the race, the main line, at least, had failed of its purpose.

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* A tax had been levied upon the traffic of the central line of railway in New York state extending from Buffalo to Albany. The object of its imposition was to protect the Erie canal and prevent the diversion of trade from this improvement. This act on the part of New York no doubt influenced the legislature of Pennsylvania in imposing a similar tax on the tonnage of the Pennsylvania railroad. An act to abolish state tolls on railroads in New York was passed on July 10th, 1851. See the Fifth Annual Report of the Directors of the Pennsylvania Railroad, February 2d, 1852.

† See Exec. Docs.. 1859, Governor's message, p. 6. It should be mentioned that by Act of May 7th, 1855, lumber and coal were exempted from the tax.

‡ See Exec. Docs., 1854, p. 10, of Governor's message.

The movement continued apace and successive governors, in their annual messages, discussed the various phases of the question in a manner which was largely non-committal. At length a select committee of the senate was appointed early in 1854 to review the whole matter. Their report of February 4th strongly insisted that public opinion, correct policy and sound morals justified and demanded a sale. "A total and complete emancipation from all the works" was urged.*

In accordance with the above suggestion, an Act of April 27th, 1854, provided for the sale of the trunk line from Philadelphia to Pittsburg.† To this end sealed tenders were asked for. No bid less than $10,000,000 would be considered. This figure, it will be remembered, was just one-half of the minimum price that was fixed for the same works ten years earlier. Although the advertisement for tenders was continued for several months, no bids were received. The canal commissioners in their report for 1854 did not discuss at all the question of making the sale, but they merely suggested that some decisive action should be taken so as to put an end to the suspense which was impairing the revenue derived from the works.‡

A persistent determination on the part of the legislature to effect a sale was shown by an Act of May 8th, of the following year.§ It was now provided that the main line should be offered at public auction in Philadelphia for not less than $7,500,000. It was also arranged that, in case no sale should then be made, "the governor should invite proposals for the purchase or lease of said works." However, when the auction was held in July, 1855, they were not sold because "the logical purchaser, the Pennsylvania Railroad Company, would not bid under the terms and conditions of the sale."‖ A few months later, however, the president of that com-

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* See Leg. Docs., 1854, p. 328.

† Laws of Pennsylvania, 1854, p. 520.

‡ Exec. Docs., 1855, Report of Canal Commissioners, p. 22.

§ Laws of Pennsylvania, 1855, p. 521.

‖ Wilson, History of the Pennsylvania Railroad Company, I, p. 46.

The Act of May 8th, 1855, provided that the purchase money should be paid in yearly instalments of $1,000,000 each. It seems reasonable to believe that the sale might have been made at this time had the conditions governing payment been more liberal. See Exec. Docs., 1855, p. 8 of Governor's message.

pany forwarded to the Secretary of State of the Commonwealth of Pennsylvania the following letter:—*

OFFICE OF THE PENNSYLVANIA RAILROAD CO.,

Philadelphia, December 20, 1855.

To the Hon. Andrew G. Curtin, Secretary of State:

Sir:— I respectfully submit on behalf of the Pennsylvania Railroad Company the following proposal for the purchase of the main line of state improvements; also, a proposal for the Columbia railroad only.

For the main line from Philadelphia to the Monongahela and Allegheny rivers including the real estate, shops, tools, engine-houses, depots, locomotives, cars, toll-houses, lock-houses, water-power and other property connected therewith, the sum of seven million five hundred thousand dollars.

Payments to be made as follows: Five hundred thousand dollars on the delivery of the works to the company, in cash or certificates of state loan; ten per cent. of the remainder on the thirtieth day of July, one thousand eight hundred and seventy-five; and ten per cent. annually thereafter until the whole amount is paid. The instalments unpaid to bear interest at the rate of five per cent. per annum, payable semi-annually on the thirtieth days of January and July of each year; the company to have the right at any time to pay off the whole or any portion of the purchase money, by the delivery to the State Treasurer of an equal amount in certificates of state loan; the state to relinquish her right to purchase the Pennsylvania railroad, and to repeal all laws imposing a tax on tonnage passing over said road.

The Pennsylvania Railroad Company will further agree to keep up the canal portion of the line east of the Allegheny mountain; also, that portion of the line between Blairsville and Pittsburg, until the Northwestern railroad shall be open for business from Blairsville to the Allegheny river.

The company will also agree to purchase the Philadelphia and Columbia Railroad at its cost of construction, to be determined by three eminent civil engineers, to be appointed by the state with the concurrence of the Pennsylvania Railroad Company; upon which sum so ascertained, they will pay forever semi-annually to the State Treasurer an amount equivalent to the dividends paid to the stockholders of said company on an equal portion of its capital stock.

Very respectfully,

Your obedient servant,

J. EDGAR THOMPSON, *President.*

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* See Leg. Docs., 1856, p. 47.

Within a month from the time of the receipt of the above letter, Governor Pollock submitted it to the consideration of the legislature which was then in session. No definite action was taken in 1856. Again, in referring to the proposal made in 1855 by the Pennsylvania Railroad Company the governor, in his message of 1857, said:—"In relation to the propriety and policy of the sale of the main line of our public improvements my opinion has not changed. Every consideration of public policy, of present and future interest, requires the separation of the state from the management and control of these works. The expenditures on that portion of the line between the Juniata and Pittsburg largely exceed the revenues, the excess averaging annually not less than $150,000; and causes are in constant operation that will still more increase this deficiency.

The continual drain on the treasury to sustain a work so unproductive should at once be checked. A sale of the main line for a fair consideration and upon terms just and liberal to our purchasers is the proper remedy. In connection with the payment of the public debt, this question becomes deeply important. The sale would constitute a new era in the financial history of the state."

The legislature forthwith proceeded to deal with the offer of the Pennsylvania Railroad Company and again on May 16th, 1857, an Act authorizing the sale of the main line at public auction was passed.* A minimum price of $7,500,000 was retained. Provision was made that, in case the above-mentioned company should buy the line, the whole amount of the sale should be paid in its bonds bearing interest at 5 per cent. per annum, payable half-yearly. These were to be redeemed as follows:—$100,000 worth on July 31st, 1858; a similar amount annually until 1890, when $1,000,000 of the balance should fall due, and the same sum each year thereafter until the whole debt should be discharged.

The auction was held at the Merchants' Exchange, Philadelphia, on June 25th, 1857, when the property was sold to J. Edgar Thompson, acting in behalf of the Pennsylvania Railroad Company.† Accordingly this corporation took possession of the main line of state works on August 1st. Bonds of the company to the amount of the purchase money were deposited with the state treasurer and held by him for the commissioners of the sinking fund. For, by

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* Laws of Pennsylvania, 1857, p. 519.

† Wilson, History of the Pennsylvania Railroad Company, I, p. 48.

the twelfth section of the Act of May 16th, the entire proceeds of the sale were required to be paid into this fund and applied to the payment of the state debt.

The later history of what had been the main line of public works confirms the belief that it had outgrown its usefulness when sold. The Pennsylvania Railroad Company operated the Portage railroad during the months of August, September and October, 1857. It was then closed owing to the excess of expenditures over receipts, and the traffic was transferred to the company's own line which crossed the mountain. The loss incurred during these three months was $7,220.14. The following year the new owners began dismantling the Portage road and removing the materials. Most of the rails were used in extending the Pittsburg, Fort Wayne and Chicago railroad from Plymouth to Chicago. Many of the stone blocks which had served as a support or foundation for the rails were removed to Altoona and used in the masonry of the railway shops.*

On the other hand, the Philadelphia and Columbia railroad was still kept in use. Indeed the Pennsylvania Railroad Company had had running privileges over it for several years previous to the date of purchase. A large part of this work was known later as the Philadelphia division of the Pennsylvania system.

The canals of the main line were operated as a canal department of the Pennsylvania Railroad Company for the period of ten years. They were found to be unprofitable, however, and were then transferred to the Pennsylvania Canal Company. They continued to be used for a number of years but the various sections were gradually abandoned. The division between Johnstown and Pittsburg ceased to be used in 1864, the one along the Juniata in 1898, and finally the eastern division in 1900.

In the meantime the sale of the main line had been quickly followed by a movement for the disposal of the lateral works. In general the arguments used in the former agitation applied equally as well in the latter. Moreover, it was at this very time that there was a serious depression in the business affairs of the country†

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* Wilson. History of the Pennsylvania Railroad Company. I, p. 152.

† "A sudden and severe financial revulsion has occurred. . . . Every department of industry has felt and been disastrously affected by the shock. Trade and commerce have been paralyzed. Many of our furnaces, rolling mills and factories have been closed. Extensive and valuable coal operations

which crippled many individuals and firms engaged in manufacturing and other industrial pursuits. Hence the demand for those commodities which constituted the bulk of the traffic on the lateral canals, viz.—coal, iron, and lumber, was now materially diminished.* While the public mind was in a morose state due to the above conditions, the time seemed ripe for the party which was anxious to sell the remainder of the improvements to precipitate the movement already in progress. Naturally enough, the advantages that would thus accrue to the state from the financial standpoint were emphasized. Governor Pollock, in pointing out the desirability of a sale from every point of view, stated: "In connection with the payment of the public debt and the reduction of state taxation the question is one of more than ordinary interest." Consequently, he urged the legislature to effect a sale "at the earliest practicable period, for a fair consideration, upon terms just and liberal to the purchasers, and at the same time amply protective of the rights and interests of the people."

On the 25th of February, 1858, the house committee on ways and means reported a bill which provided for the sale of all the transportation improvements still owned by the state; also for the completion of the Sunbury and Erie railroad. Though stoutly opposed by a respectable minority, the bill was finally passed and received the governor's approval on April 21st, 1858.† It authorized the Sunbury and Erie Railroad Company to purchase all of the lateral works for $3,500,000. Furthermore, this company was to issue bonds to the amount of $7,000,000, bearing interest at 5 per cent. per annum and secured by mortgage upon the whole line between Sunbury and Erie. These to the amount of the purchase money were to be given to the state. The rest were to be deposited with the state treasurer and ultimately were to be surrendered to the company under certain specified conditions which, as already intimated, had in view the speedy completion of the road.‡

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have been suspended or abandoned and thousands of workmen are out of employment."—Extract from Governor Pollock's special message to the extra session of the legislature, Oct. 6th, 1857, in Exec. Does., 1857.

* See page 3 of Report of the State Engineer in Exec. Does., 1857.

† Laws of Pennsylvania, 1858, p. 414.

‡ Sunbury, situated at the confluence of the north and west branches of the Susquehanna, was connected with Philadelphia by the state improvements. With a view to regain the trade and commercial position lost by

It was provided also that the Sunbury and Erie Railroad Company might sell any or all of the lateral canals should it seem desirable to do so at a future date. This privilege was subject to the condition that, if the works should be sold for more than $3,500,000, three-fourths of the excess above this amount should be paid into the state treasury. Subsequently all of the canals were disposed of for the aggregate sum of $3,875,000.* Accordingly, $281,250 of this amount were handed over to the state.

The complete withdrawal of the state from the ownership and control of the transportation improvements was the cause apparently of little or no regret either at the time of the sale or afterwards. As nearly as can be estimated, the words of Governor Packer in his message to the legislature in January, 1859, represented the prevailing feeling regarding this matter. He said:—"I have an abiding confidence that the result will abundantly prove the wisdom of the measure which, while it guaranteed the completion of one of the greatest improvements ever projected in the commonwealth, it at the same time divorced the state from the unprofitable and demoralizing management of her canals and railroads. Whatever differences of opinion may at any time have been entertained in regard to the propriety of the details of the legislation authorizing the sale of the main line or branches, it can scarcely be doubted that the public welfare will, in every respect, be vastly promoted by the transfer of the management of the public works from the state to individual owners. The short experience that we have already had proves conclusively that the commonwealth

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Philadelphia on account of the Erie canal, a railroad was commenced between Sunbury and Lake Erie by authority of an Act of April 3d, 1837, which chartered the Sunbury and Erie Railroad Company. Very little was done toward building the road, however, up until the time of the sale of the public works. It was believed that by the terms of the bill reported on February 25th, 1858, the railway would be completed. By Act of March 7th, 1861, the name was changed to "The Philadelphia and Erie Railroad Company," and on January 6th, 1862, it leased its property to the Pennsylvania Railroad Company for 999 years.

* Sales were made as follows:—The upper and lower North Branch divisions were sold to the North Branch Canal Company for $1,600,000; the West Branch and Susquehanna divisions to the West Branch and Susquehanna Canal Company for $500,000; the Delaware division to the Delaware Canal Company for $1,775,000; total, $3,875,000.—See Exec. Docs., 1858, Governor's Message, p. 6.

is greatly the gainer in a financial point of view, and it has been equally demonstrated that the people at large have been as well if not better accommodated by the change. It would in my judgment be a public calamity if, by the happening of any contingency, the commonwealth should be constrained to again become the owner and resume the management of any portion of the public improvements."* Again, the following year, the governor in referring to the same subject commented upon the gratifying results already shown after two years of separation from the management and control of the canals and railways, and the consequent simplification of governmental action. From these and other contemporary comments it seems clear that the majority of the leading men of the state united in commending the government for selling the public works.

There being no longer any cause for the existence of the board of canal commissioners, it was formally abolished by an Act of January 25th, 1859. In accordance with the provisions of this act, the books, papers, records and all other property belonging to the canal board were handed over to the auditor general of the state. In his custody they remained until, by authority of an Act of February 26th, 1885, they were transferred to the Department of Internal Affairs, where they still remain.

To-day the traveller, in going between Philadelphia and Pittsburg via the Pennsylvania railroad, may see portions of the abandoned state works. From the windows of the coaches gliding along at almost lightning speed, one may catch glimpses, here and there, of the old canals and Portage railroad, which, at one time, were the pride of the commonwealth. In the present age of wonderful material advancement, rapid progress is made in the evolution of transportation systems. Of these, one that is entirely adequate for its purpose in any particular decade may be totally deficient in the next. The public works of Pennsylvania, which at one time were believed to be the highest development possible in the field of inland transportation, had their day and were practically abandoned in scarcely more than twenty-five years. These works now are rapidly falling into decay. The Portage railroad is gradually becoming overgrown with grasses and trees. Its wooden structures and masonry are nothing but ruins. Along the canals the old boats may

* Exec. Docs., 1858, p. 7.

be seen at the landings where they were last used. These as well as the timbers in the locks, are being broken up and used for fuel. Moreover, stretches of the canals which are in evidence to-day, tomorrow may be filled up in order to meet the ever-increasing demands for the expansion of the Pennsylvania railway system.

At present only four canals are being operated in Pennsylvania.* Their combined length is 240.88 miles—a small fraction of the total mileage of the public- and private-owned works which existed within the limits of the state during the second quarter of the nineteenth century, when the principal avenues of inland transportation were natural and artificial waterways.

APPENDICES.

Appendix I.—*Memorial to the Legislature.*

The following is a copy of the memorial to the Legislature of Pennsylvania prepared and issued by the "Committee of Twenty-four," for general circulation throughout the state. This committee was appointed at a public convention of the citizens of the city and county of Philadelphia held on January 24th, 1825. A full text of this memorial is contained in the United States Gazette of February 11th, 1825.

"To the Honorable the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, the Memorial of the Subscribers, Citizens of
County of respectfully sheweth:—

That your Memorialists are deeply impressed with a sense of the importance of a Canal Navigation in Pennsylvania, from the Susquehanna to the Allegheny Rivers, and from the Allegheny River to Lake Erie, and they think the work ought to be undertaken by the State, and executed at the expense of the State, with the least possible delay.

Your Memorialists are fully convinced that the present is a favorable moment for the commencement of the work. The skill and experience which have been developed and acquired in the prosecution of similar enterprises in the State of Pennsylvania and other States of the Union, will ensure its efficient and economical execution; and there is no doubt that it can be better done, and upon

* Delaware division canal from Bristol to Easton, 60 miles: Lehigh Coal and Navigation from Coal Port to Easton, 48 miles; Pennsylvania canal from Montoursville to Selinsgrove, 43 miles: Schuylkill Navigation from Port Clinton to Philadelphia, 89.88 miles.

better terms, than any work of the kind heretofore undertaken in the United States.

The abundance of capital now seeking employment, and the high credit of the State, render it almost certain that the requisite funds can be had upon very moderate terms; and, in connection with this part of the subject, your Memorialists would beg leave to remark, that as the money will be wanted only in proportion to the progress of the work, the debt, which it may be necessary at any one time to contract, will not be large; and no very long time will elapse before the income of the navigation will itself relieve the State from the burden of providing for the payment of interest. They feel themselves warranted, indeed, by experience, in saying that it will do much more; that it will soon afford the means of gradually extinguishing the debt which may be contracted, and make a large permanent addition to the fiscal means of the State, and thus be highly advantageous as a mere measure of finance.

The Schuylkill Navigation being now happily completed, and the Union Canal in a state of forwardness, which leaves no doubt that, with suitable public support and encouragement, it will soon be finished, we may almost regard the communication between the Delaware and the Susquehanna as already opened. From the Susquehanna to the Allegheny and Lake Erie, we are led to believe that greater difficulties will not be found than have been encountered and overcome in the works just mentioned; and we are confident there are none which the united forces of the Commonwealth, and the means at her command, will not be sufficient easily to surmount. The line of communication being thus extended, there will be a continued navigation through the State of Pennsylvania, connecting Lake Erie with the Delaware and the Ocean!

On the immense advantages to be derived from such a communication, it must be wholly superfluous to dwell. They have long engaged the attention of many of our best and wisest citizens. Thirty years ago the country was explored and the routes examined, by which it was supposed the Eastern and Western waters might most easily be connected, and efforts were made to commence the work. They failed it is true, for they were perhaps premature. But if, with the spirit that dared at that early day to conceive so great a design, there had been united the means which are now possessed by the State there can be no doubt that their exertions would have been crowned with success, and that Pennsylvania would, at this moment, be enjoying the fruits of their patriotic labors even far beyond what their most sanguine calculations could have anticipated.

Without adverting to the great increase of wealth and population which has since taken place, and the consequent increase of capacity for great undertakings, one single fact may suffice to show the difference in our favor. At the period referred to, there was not a canal in the United States. There was not, it is believed, in our Country at that time sufficient skill in civil engineering even to

make the necessary preliminary arrangements for cutting a canal; or if it existed, it was entirely unknown. But now we have examples before us of canals in active and profitable operation, and in almost every stage of progress towards completion. The mode of constructing them, and their uses and profits when constructed, are no longer matters of speculation, but of actual and satisfactory experiment. At the same time, the requisite skill has been supplied from the talents of our countrymen, who with their usual ingenuity have invented improved methods of working, adapted to our circumstances, so that the State would have no difficulty at this time in obtaining immediately, within the United States, the aid of an adequate number of skilful and experienced engineers, to survey and lay out a route, and direct the execution of the work, whose well-established reputation would secure the public confidence in whatever plan they might adopt and recommend, and be a sufficient guarantee to the State for its unquestionable title to preference.

To these considerations your Memorialists would add, that, since the period referred to, the invention of steamboats by Fulton, a native of Pennsylvania, has served more fully to disclose an inland navigation towards the northwest of many hundreds of miles beyond the town of Erie, the benefits of which would be opened to the State of Pennsylvania by the work now proposed.

But there is one consideration of such paramount importance as to deserve, in the opinion of your Memorialists, the most serious attention of the Legislature, and of every citizen of Pennsylvania. It is this,—that henceforward the intercourse between the East and West is to be carried on by means of inland navigation. This is decided by what is already done. No State, therefore, can expect to participate largely or beneficially in this interesting intercourse, unless she offer such a channel of communication. The cheapness and expedition of transportation by water are so far beyond those of any other mode of conveyance within our reach, as to put competition entirely out of the question. This single fact your Memorialists believe to be of sufficient weight to render all argument superfluous, unless we are disposed to give up the well-earned reputation of Pennsylvania, and to suffer her to fall back from her established character and standing.

Your Memorialists would not be understood to make any invidious comparisons, nor to indulge in unworthy jealousies, nor to endeavor to excite unreasonable State feeling. They rejoice in the successful efforts of our brethren in other states in the cause of internal improvement, as a valuable contribution to the honor and strength of the whole, and would note them only as examples to be imitated. But they would at the same time remark, that whoever considers with due attention the structure of the Federal Government, and the foundation upon which it rests, must be fully and feelingly convinced of this great truth, that no State performs her duty well to the Union, that does not well perform her duty to herself.

With all the advantages possessed by Pennsylvania, in her institutions, her climate, her soil, her mineral resources, her moral and

intelligent population, with the inducements offered by the interesting position she occupies in the Union, and by the high social and political obligations which she owes no less to herself than to the Union, and to her Sister States, and which plainly require that she should at all times endeavor to maintain her relative standing and character, your Memorialists are confident that the public sentiments will sustain them in urging with earnestness upon the representatives of the freemen of Pennsylvania, the immediate adoption of decisive measures for commencing the work, and prosecuting it to completion with all the energy of the State.

And your Memorialists would fain hope that local wishes or views will not be allowed to interfere with or retard the undertaking; but that it will proceed upon enlarged principles, by the most direct practicable route. They admit that whatever may be its locality, the benefit will in the first instance be most felt by the immediate neighborhood. This is unavoidable. But it is also true, that whatever its locality, every part of the State will in some degree feel its happy influence; and in a little time other works will be contrived and executed for extending its use by lateral connections, through every quarter of the State from which it is accessible.

Your Memorialists need not insist upon the influence which the work will have in multiplying and strengthening our connections with the States in the West; nor upon its happy influence in uniting more closely the citizens of Pennsylvania and diffusing more equally the advantages of access to markets for every sort of commodity. As to its beneficial effects, all agree; of its practicability, no one, we believe, now entertains a doubt; of the power of the State to command the necessary means for its execution, we think there can be no question. Your Memorialists, therefore, again most earnestly request your Honourable Bodies to take the subject into your consideration, and adopt the necessary measures for giving effect to their wishes."

Appendix II.—*Delegates to the Canal Convention at Harrisburg.*

The following list contains the names of the delegates appointed to represent the various counties of the State of Pennsylvania at the Canal Convention held at Harrisburg from August 4th to 6th, 1825. Those whose names are in italics represented the opposition. This list was taken from the United States Gazette of August 12th, 1825.

County.	Delegates.
Adams	John Dickson, Samuel Sloan.
Allegheny	Ephraim Pentland, Joseph Patterson, Matthew E. Lowrie, Harmer Denney.
Armstrong	Thomas Blair.
Bedford	*John Todd, James M. Russel.*
Berks	Lewis Reese, Nathaniel Hobart, Isaac Hiester, Henry S. Kline, Peter Eckhart.
Bradford	*Edward Herrick.*
Bucks	Samuel D. Ingham, William Carr, John W. Wynkoop, Mathias Morris, Henry Chapman.
Butler	John Gilmore.
Cambria	Moses Canan, John Bredin.
Centre and Clearfield	Thomas Burnside, Francis W. Raule.
Chester	David Townsend, Joseph Sharpe, Joshua Evans, *Joshua Hunt.*
Columbia	Daniel Montgomery, Christian Brobst, John McReynolds.
Crawford	John B. Wallace, Arthur Cullum.
Cumberland	*Robert McCoy. Jacob Alter, Henry Vethake.*
Dauphin	John Forster, William Lauman, Silas Marsh.
Delaware	George G. Lieper, Thomas Smith.
Erie	Thomas H. Sill, Giles Sanford.
Fayette	James Todd, Samuel Evans, Thomas Erwin, John Kennedy.
Franklin	*Robert Smith, Thos. H. Crawford, Geo. Chambers.*
Greene	William S. Harvey, Robert Whitehill.
Huntingdon	John Scott, John Blair.
Indiana and Jefferson	None.
Lancaster	*Robert W. Houston, Thomas Neill, Hugh McCullough, James Buchanan, Geo. B. Porter, Jacob Peelor.*
Lebanon	*Nathaniel H. Loring,* Joseph Barnett.
Lehigh	*Henry King,* Stephen Balliet, *James Rodrock.*
Luzerne	Jacob Cist, Nathan Beach.
Lycoming	Robert McClure, Andrew D. Hepburn.
Mercer	Thomas S. Cunningham.
Mifflin	David W. Huling, Mr. Crawford.
Montgomery	Levi Pawling, Philip S. Markley, Thos. Baird, Jacob Dewees.
Northampton	*Jas. M. Porter, Wm. Broadhead, M. R. Butz.*
Northumberland	Lewis Dewart, William Tweed.
Perry	Abraham Addams.
Philadelphia—	
City	Mathew Carey, John Sergeant, Manuel Eyre, Chas. J. Ingersoll, Wm. Lehman, Wm. J. Duane.
County	George W. Ritter, Samuel Breck, Jas. Ronaldson, Samuel Humphreys, Jacob Holgate, Jas. A. Mahany, Joel B. Sutherland.
Potter and McKean	Jonathan Colgrove.
Schuylkill	Thomas S. Ridgeway.
Somerset	John Gebhart, Abraham Morrison.
Susquehanna	Jabez Hyde, Jr., Frederick Baily.
Tioga	Uriah Spencer.
Union	Mr. Middleswarth, James Merril, Geo. Kremer.
Vanango	Alex. McCalmont.
Warren	Archibald S. Tanner.
Washington	Joseph Lawrence, Joseph Ritner, Alex. Reed, Thomas H. Baird, Thos. McGiffin.
Wayne and Pike	*John Coalbaugh.*
Westmoreland	John Young, James Clarke, Andrew Boggs.
York	*Chas. A. Barnitz, Samuel Martin, William Diven, George Nace, John Gardner, Mr. Smitzer.*

Appendix III.—*Resolutions Passed at the Canal Convention at Harrisburg, August 4th to 6th,* 1825.

The following resolutions were framed by a committee appointed by the Harrisburg Convention on Internal Improvements. They were presented to that body for consideration and after much discussion they were adopted.*

Whereas, The great interests of the State of Pennsylvania require that there should be a steady perseverance in improving the resources of wealth and strength, and social comfort which abound within her limits; and

Whereas, The time has arrived when she is called upon by every consideration of regard for her character and standing, as well as for her permanent prosperity and happiness, to make a vigorous and united exertion for accomplishing, without delay, the connection of the eastern and the western waters by a line of communication within her borders; and

Whereas, A distinct and solemn expression of the deliberate opinion of the people is always of powerful efficacy, and is especially fit and requisite upon an occasion like the present, where an extraordinary effort is necessary for the common advantage of the whole, the public will being the only sure authority for the undertaking and the best pledge for its energetic and zealous prosecution; therefore,

Resolved, That the improvement of the Commonwealth will be best promoted, and the foundations of her prosperity and happiness most securely established, by opening an entire and complete communication within her borders, from the Susquehanna to the Allegheny and Ohio, and from the Allegheny to Lake Erie, by the nearest and best practicable route, and that such work is indispensably necessary to maintain the character and standing of the State, and to preserve her strength and resources.

Resolved, That the application of the resources of the State to this undertaking ought not to be regarded as an expenditure, but as a most beneficial investment; for its successful execution will increase the public wealth, improve the public revenue, and greatly enlarge the ability of the State to extend her aid to every quarter where it may be wanted, and, at the same time, will encourage industry, create circulation, extend trade and commerce, enhance the value of land, and of agricultural and mineral products, and thereby augment the means of the citizens to promote his own and the public welfare by contributions to similar works.

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* See page 184: also the footnote concerning the words struck out of the first resolution; and the reference to an additional resolution that was passed.

Resolved, That all local objects, tending to a diffusive and unconnected application of the public means, ought, for the present, to yield so as to allow an undivided exertion of the public strength in this great undertaking, which is essential to its speedy and successful prosecution; for, though it be certain, that, whatever may be its location, the benefit will be most sensibly felt, in the first instance in the immediate neighborhood, yet it is also true that its invigorating influence will pervade every part of the Commonwealth, and, in a short time, its branches will spread in all directions, wherever the bounty of Providence has furnished the means of access to the great channel thus provided, and, encouraged by this example, new channels will be successfully opened as occasion may offer, or the public exigencies and the demands of the country may require.

Resolved, That, in our opinion, the people of Pennsylvania will fully sustain the Legislature in all such measures as may be necessary for effectuating this highly important and interesting object, as we believe them to be fully sensible to its political and social value, and they have never refused to support, to the utmost of their ability, what their enlightened and patriotic judgment approved as fit to be done for the common good.

Resolved, That we regard, with satisfaction, the efforts of our sister states to make extended improvements, and that, in our opinion, a wise and liberal policy requires of Pennsylvania to grant to them every just and legal facility, whenever her concurrence may be necessary to their successful prosecution, and that we have witnessed, with pleasure, the progress made towards laying out a canal from the Potomac to the Ohio, as well as the steps taken by the State of New York for forming a connection with the north branch of the Susquehanna.

Resolved, That a general committee of correspondence be appointed, and that they be requested to prepare an address to the people of Pennsylvania upon the subject of internal improvements.

Appendix IV.—*Act of 25th February,* 1826—*Pamphlet Laws, Page* 55.

An Act: To provide for the commencement of a Canal, to be constructed at the expense of the State, and to be styled "The Pennsylvania Canal."

Whereas, The construction of a canal within our own limits for the purpose of connecting the eastern and western waters, is believed to be practicable, and within the means of the state, and its speedy completion will advance the prosperity and elevate the character of Pennsylvania; and by facilitating intercourse and promoting social interests will strengthen the bands of the Union: *And whereas,* There are important sections of the work which may be immediately begun, without the danger of error; therefore, *Resolved:*

Section 1. That the commissioners appointed by the act entitled "An act to appoint a board of canal commissioners," passed the eleventh day of April, eighteen hundred and twenty-five, are hereby authorized and empowered, in behalf of this state, immediately to locate and contract for making a canal and locks, and other works necessary thereto, from the river Swatara, at or near Middletown, to or near a point on the east side of the river Susquehanna, opposite the mouth of the river Juniata; and from Pittsburg to the mouth of the Kiskeminetas; and also as soon as they shall deem it expedient and practicable, to construct a navigable feeder of a canal, from French Creek to the summit level at Conneaut lake, sufficient to convey at least two hundred and twenty-one cubic feet of water per second, and to survey and locate the route of a canal from thence to Lake Erie: *provided*, That if it shall be found necessary, in order to construct the said canals, to obstruct the navigation of either of the rivers Susquehanna and Allegheny, by dams or other means, that before such obstructions shall be authorized to be made, that the said commissioners shall cause to be made a means of navigation, in either or both of said rivers, equally safe and practicable as now exist in the said rivers.

Section 2. That the said commissioners shall be authorized to appoint one or two of the board, as occasion may require, as acting commissioner or commissioners, who shall receive four dollars per day, each, while actually engaged in the superintendence of the works contemplated by this act, and which sum shall be in full of all compensation for services and expenses.

Section 3. That the state treasurer for the time being shall, in addition to his official duties, act as treasurer to the board of canal commissioners; and that said board shall have the power to appoint engineers, clerks, and other officers, toll gatherers and such other agents as they may judge requisite; and to agree for and settle their respective wages, and to establish reasonable toll.

Section 4. That it shall be the duty of each and every acting canal commissioner, appointed in pursuance of this act, to superintend the making and constructing of said canal, before entering upon the duties of his office, to enter into bond to the commonwealth, with at least two substantial freeholders as sureties, in the penal sum of fifty thousand dollars, conditioned for the faithful accounting of all moneys entrusted to him as canal commissioner, whenever and as often as he may be required to do so by law, or by concurrent resolution of the senate and house of representatives, or by the accounting officers of the treasury department; and the said bond shall be approved by the governor, and filed in the office of the secretary of the commonwealth.

Section 5. That whenever the sum or sums of money paid to any canal commissioner, shall amount to fifty thousand dollars, it shall not be lawful for the treasurer of the board to advance or pay to such canal commissioners, any further sum or sums of money, until he shall first have produced an account and vouchers,

to the accounting officers of the treasury department, showing the payment and expenditures of the money received by him.

Section 6. That in order the better to guard against mistakes and losses, it shall be the duty of the acting canal commissioners respectively to take duplicate receipts for all sums of money which they may advance and pay to their engineers, contractors and agents, one whereof, in each and every case, shall be filed with the accounting officers of the treasury department; and all contracts for the construction of any part of the improvements contemplated by this act, shall be made in writing, one copy of which shall be forthwith deposited with the state treasurer, and one copy shall be given to and retained by the contractor; and at least thirty days notice shall be given in one or more of the newspapers printed in Philadelphia, Harrisburg and Pittsburg, respectively, and in such other newspapers as may be deemed expedient by the canal commissioners, or a majority of them, of the time and place at which proposals will be received for entering into such contracts; and no extra allowance shall in any case be made, for the performance of any such contract, beyond the sum stipulated therein.

Section 7. That the location and dimensions of the said canals and locks shall be determined by a majority of the board, with the approbation of a skilful engineer, and with the consent of the governor.

Section 8. That it shall and may be lawful for the said board, or a majority of them, to agree with the owner or owners of any land through which the said canal is intended to pass, for the purchase, use, and occupation thereof, on behalf of the state; and in case of disagreement, or in case the owner or owners thereof shall be a feme coverte, under age, non compos, out of the state or county, on application to a justice of the county in which such land shall be, the said justice of the peace shall issue his warrant, under his hand, to the sheriff of the county, to summon a jury of eighteen inhabitants of his county, not related to the parties, nor in any manner interested, to meet on the land to be valued, at a day to be expressed in the warrant, not less than ten nor more than twenty days thereafter; and the sheriff, upon receiving the said warrant, shall forthwith summon the said jury, and when met, shall administer an oath or affirmation to every juryman who shall appear, being not less than twelve in number, that he will faithfully, justly and impartially value the land, and all damages the owner or owners shall sustain, by cutting the canal through such land, or the partial or temporary appropriation, use or occupation of such land, according to the best of his skill and judgment; and that in such valuation, he will not spare any person or persons, for favor or affection, or any person or persons grieve, for malice, hatred or ill-will; and in every such valuation and assessment of damages, the jury shall be, and they are hereby instructed to consider, in determining and fixing the amount thereof, the actual benefit which will accrue to the owner or owners from conducting the said canal

through, or erecting any of the said works upon his land, and to regulate their verdict thereby, except that no assessment shall require any such owner or owners to pay or contribute anything, where such benefit shall exceed, in the estimate of the jury, the value and damages ascertained as aforesaid; and the inquisition thereupon taken, shall be signed by the sheriff and some twelve or more of the jury, and returned by the sheriff to the clerk or prothonotary of his county; and unless good cause be shown against the said inquisition, it shall be affirmed by the court and recorded; but if the said inquisition should be set aside, or if, from any cause, no inquisition shall be returned to such court within a reasonable time, the said court may, at its discretion, as often as may be necessary, direct another inquisition to be taken, in the manner above prescribed; and upon every such valuation, the jury is hereby directed to describe and ascertain the bounds of the land by them valued, and the quality and duration of the interest and estate in the same, required by the said board, for the use of the state, and their valuation shall be conclusive on all persons, and shall be paid for by the said board, to the owner or owners of the land, or his, her, or their legal representatives; and on payment thereof, the state shall be seized of such lands as of an absolute estate in perpetuity, or with such less quantity and duration of interest or estate in the same, or subject to such partial or temporary appropriation, use or occupation, as shall be required and described as aforesaid, as if conveyed by the owner or owners; and whenever, in the construction of the said canal, or any of the works thereof, locks, dams, ponds, feeders, tunnels, aqueducts, culverts, bridges, or works of any other description whatsoever, appurtenant thereto, it shall be necessary to use earth, timber, stone or gravel, or any other material, to be found on any of the lands adjacent or near thereto, and the said board or their agent cannot procure the same for the works aforesaid, by private contract of the proprietor or proprietors, owner or owners; or in case the owner or owners should be a feme coverte, non compos, or under age or out of the state or county, the same proceedings, in all respects shall be had, as in the case aforementioned, of the assessment and condemnation of the lands required for the said canal, or the works appurtenant thereto.

Section 9. That every person actually engaged in laboring on any canal authorized by law, shall be exempt from doing militia duty in this state except in cases of insurrection or invasion, during the time when he is so actually engaged; and the certificates of the contractor, who shall employ such men, so liable to perform militia duty, in the performance of their contracts, shall be prima facie evidence of such engagement.

Section 10. That the sum of three hundred thousand dollars be, and the same is hereby appropriated, to be paid by the state treasurer, in such sums as shall be required for the execution of the work, which sums shall from time to time be paid into the hands of the acting canal commissioner or commissioners, by direction of

a majority of the board, and by warrant of the governor, subject to the provisions of the fifth section of this act.

Section 11. That the commissioners aforesaid be, and they are hereby authorized, if they shall deem it proper and expedient, to agree with the president and managers of the Harrisburg canal, fire insurance and water company, for taking water from the canal herein provided to be made, from such point on the same, as shall be deemed by said commissioners least injurious to the said canal, and least likely to impede the navigation thereof, for supplying the borough of Harrisburg with water, and for propelling machinery.

Section 12. That it shall be the duty of the canal commissioners, on or before the first Monday of February, in each and every year, to settle and account with the accounting officers of the treasury department, for all moneys by them received from the treasurer of the board; and it shall be the duty of the auditor general to report the settlement so made, to the legislature, as soon thereafter as may be, detailing the sums allowed by them to the engineers and agents respectively employed in the superintendence and construction of said canal, and the works connected therewith.

Appendix V.—*Act of 9th April,* 1827—*Pamphlet Laws, Page* 192.

An Act: To provide for the further extension of the Pennsylvania Canal.

Section 1. That the board of canal commissioners are hereby authorized and required, in behalf of this commonwealth, as speedily as may be, to locate and contract for making a canal, locks, and other works necessary thereto, up the valley of the Juniata, from the eastern section of the Pennsylvania canal, to a point at or near Lewistown; also a canal, locks and other works necessary thereto, up the valley of the Kiskeminetas and the Conemaugh, from the western section of the Pennsylvania canal, to a point at or near Blairsville; and also a canal, locks and other works necessary thereto, up the valley of the Susquehanna, from the said eastern section of the Pennsylvania canal, to a point at or near the town of Northumberland, to be selected with due regard to the accommodation of the trade of both branches of said river. And the said board shall also proceed to make or cause to be made, such examinations and surveys from Frankstown on the Juniata, to Johnstown on the Conemaugh, across the Allegheny mountain, as may enable them to determine in what manner, and by what kind of works, whether by the construction of a smooth and permanent road of easy gradation, or by a railway with locomotive or stationary engines or otherwise, the portage or space between the said two points may be passed so as to ensure the greatest public advantage. And the said board shall also cause further examinations, surveys and levels to be made, with a view of ascertaining the practicability and cost of an entire navigable communication between the West Branch of the Susque-

hanna and the Allegheny river. And such further examinations, surveys and levels as may be necessary to ascertain the location and costs of canals, locks and other works necessary thereto, on the respective routes following, to-wit: From Northumberland up the North Branch of the Susquehanna, to the state line; from the western section of the Pennsylvania canal, near the mouth of the Kiskeminetas to a point on Lake Erie, by the Allegheny river and French Creek, at or near the borough of Erie; and from the city of Pittsburg to the said point on Lake Erie, by the route of Beaver and Shenango, and shall make to the legislature, as soon as practicable, detailed reports accompanied with maps, plans and estimates of cost of the several routes to be examined and surveyed as aforesaid.

Section 2. That before the commissioners shall determine on the location of the canal from the mouth of the Juniata river to Mifflin or Lewistown, they shall cause further examinations to be made on each side of the Juniata, by at least two of the most experienced engineers in the service of the board, in order to ascertain which side of the river is most favorable and most proper to be adopted for the construction of the canal; and a majority of the whole number of canal commissioners are hereby required to concur in the manner and place at which the said canal shall cross the Susquehanna, and if a majority of the said commissioners should decide in favor of crossing the Susquehanna by an aqueduct or a towing path bridge, they are hereby authorized to connect a bridge with it, should they believe the same practicable, and advantageous to the state.

Section 3. That it shall be the duty of the board of canal commissioners, to cause examination, survey, and estimate of the route for canal, and also for a railway, with locomotive or stationary engines, from Philadelphia, through Chester and Lancaster counties, so as to connect by the nearest and most eligible route with the eastern section of the Pennsylvania canal; and in addition thereto, to cause the necessary surveys, examinations and estimates to be made down the Brandywine river, to a point north of the Delaware state line; thence across the dividing ridge between said river and Chester creek, thence down the same to the river Delaware. And if it should be ascertained that the waters of the Brandywine cannot be diverted from their natural channel, then to make all the necessary examinations for a portage or railway across said ridge. And they shall also cause an examination or survey to be made, to ascertain the practicability and cost of forming a connection of the North Branch of the Susquehanna and the Lehigh rivers, by means of canal or railway. And the canal commissioners shall also cause surveys and estimates to be made as soon as convenient, from the termination of the Pennsylvania canal at the mouth of the Swatara, down the east and west sides of the Susquehanna river to the Maryland line, and make report to the next legislature, of the expense and practicability of extending the Pennsylvania canal to the intersection of the Maryland line and the said river.

Section 4. That the board of canal commissioners are authorized and required to commence operations on the feeder from French Creek, to the summit level at Conneaut lake; and to contract for so much as may be adapted to either of the routes in contemplation, for the purpose of connecting the Pennsylvania canal with Lake Erie. And the further sum of one hundred thousand dollars is hereby appropriated to carry into effect the provisions of this section, to be paid in like manner as is prescribed in the eighteenth section of this act; and the said commissioners shall cause an examination to be made, from the mouth of French Creek, by way of Waterford, to the bay of Presque Isle, and from Conneaut lake to Lake Erie.

Section 5. That if it shall be found necessary in order to construct the said canals and works, to obstruct the navigation of the Susquehanna, the Juniata, the Kiskeminetas, or any of their navigable branches, by dams or other means, that before such obstructions shall be made, the said commissioners shall cause to be made a means of navigation equally safe and practicable as now exists, at such place or places so to be obstructed.

Section 6. That it shall be the duty of the board of canal commissioners, during the ensuing summer, to cause examinations, surveys and estimates to be made along the valley of the Delaware, from Philadelphia, or from Bristol or any intermediate point between Bristol and the head of tide water to Carpenter's Point, with the view of ascertaining the most eligible mode of effecting a navigable canal communication, and the said commissioners shall report in like manner as is directed by law in relation to other canal routes.

Section 7. That if after suitable examination as aforesaid, by competent engineers, it should appear to the board of canal commissioners that a navigable canal can be constructed between a point at or near Philadelphia, or at Bristol, or any intermediate point between Bristol and the head of tide water, and a point at or near the borough of Easton, then, with the consent of the government, the board of canal commissioners are hereby authorized and required, in behalf of this commonwealth, during the ensuing season, to locate and contract for making a portion of said navigable communication, the expense of which shall not exceed one hundred thousand dollars, and such locks and other works as may be necessary thereto: *provided*, The average expense thereof shall not exceed twelve thousand dollars per mile; and the further sum of one hundred thousand dollars is hereby appropriated towards the accomplishment of the aforesaid object, to be paid in like manner as is provided for by the eighteenth section of this act: *provided*, That the existing natural navigation of the river Delaware shall not be obstructed or injured by the construction of said canal.

Section 8. That if any person shall consider himself aggrieved, by reason of the canal passing through the lands of which he is owner, or by interfering in any manner with his rights of property, he may at the completion of the work thereupon, or within one

year thereafter, petition the court of quarter sessions of the county in which the damage has been committed, and the said court shall appoint five reputable citizens within the judicial district of which the said county is a part, and not residing in or inhabitants of the said county, whose duty it shall be, after being severally sworn or affirmed, to view the premises, and taking into consideration the advantages of said canal to the petitioner, report such damage, if any, as they or any three of them shall think the owner has sustained by reason of said canal; and in case the said viewers are of opinion that the petitioner has received no damage, or that the advantages derived from the canal are sufficient compensation to the petitioner for any injury sustained by him, they will also report the same to the said court; for all which services the said viewers shall receive two dollars for every day employed, and three cents for every mile they shall necessarily travel in the performance of such service, the costs of such proceedings, wherever the viewers report no damage, shall be paid by the petitioner: and upon the approbation of the said court to the report of the said viewers, and the certificate of the prothonotary to the amount, the acting canal commissioner shall and he is hereby required to pay to the said petitioner the full amount of damages and costs assessed as aforesaid: *provided,* That the petitioner shall be required to give reasonable notice to the nearest acting canal commissioner, of the time and place when and where the said viewers are to meet for the purpose aforesaid: *and provided also,* That the right to except to the report of said viewers, by either party, shall be and remain the same as is extended to reports of viewers for road damages, under the existing laws of this commonwealth: *provided further*, That in cases where small portions of private property are or may be in a great measure destroyed by the public works, and where, in the opinion of the commissioners, it would be more advantageous to purchase the land, than pay the probable amount of an assessment of damages, said commissioners are hereby authorized to purchase said lands on behalf of the state, and to sell the remainder not occupied by the canal, and convey to the purchasers respectively the estate and title thus acquired. And in cases where fences may be thrown down, fields laid open, or crops and gardens destroyed by the temporary occupancy of the ground in constructing the canal, the acting commissioner shall have power to settle with and pay the owner such damages as may be reasonable and just; not exceeding in any one case the sum of twenty dollars, without the approbation of the board. And said board is hereby authorized to make an amicable adjustment of any damages, whatever, sustained by the owner or owners of any land through which any canal or railroad to be made at the expense of the state, passes or is intended to pass; and nothing herein contained shall be construed to prevent said board, or a majority of them, from agreeing with the owner or owners of any land, (through which any canal to be made at the expense of the state, passes or is intended to pass) for the purchase, use and occupation thereof, on behalf of the state.

Section 9. That the acting canal commissioners on each section of the canal respectively, be, and are hereby authorized to make such alterations as may appear to be expedient, in the route and location of any state, county, or township road, along which, or in the immediate vicinity whereof, the canal or any part thereof does or shall pass, and to lay out and open to such width as shall be necessary, so much of any of the said roads as shall be re-located; and such new route of any of the said roads shall be considered as a public highway, be supported and kept in repair as other highways in this commonwealth are supported and kept in repair; and so much of the route of any road as may be altered, shall be thereby vacated; and the said acting canal commissioners respectively, are hereby required to make a report of the alterations made in the route of any road, under the provisions of this section, to the clerk of the quarter sessions of the county wherein the said road is located; *provided,* That any person interested who may be dissatisfied with the determination of said commissioners, shall have the right of appealing by petition, to the board of canal commissioners, whose determination thereon shall be final.

Section 10. That the canal commissioners be and they are hereby required, during the ensuing year, to call upon and receive, or cause to be called upon and received, from all and every person or persons, as far as conveniently can be done, who are the owners of land, along or near the several proposed lines of canals, as provided for in this act, acquittances or releases from any claim to damages, in case the said lines of communication shall pass through their lands, and for materials that may be taken to carry on the work.

Section 11. That the commissioners are hereby required, as soon as may be convenient, to cause surveys and estimates to be made through the valleys of the Conodoguinnet, Yellow Breeches and Conocheague creeks, with a view to the connection of the rivers Susquehanna and Potomac, by a canal, and make report of the practicability and probable expense thereof; and also to view and examine the ground from the west end of the Harrisburg bridge to the borough of Chambersburg, in the county of Franklin, and from the west end of Columbia bridge, through York and Gettysburg, to Chambersburg, for the purpose of constructing a railroad, and make an estimate of the probable expense for constructing said railroad, and make report thereof to the governor, who is hereby required to lay the same before the legislature, on or before the first day of January, eighteen hundred and twenty-eight.

Section 12. That the board of canal commissioners are hereby authorized and required, if they deem it necessary, previous to the location of that part of the canal from the eastern section to a point at or near Northumberland, on the West Branch, to cause a survey and exploration on the east side of the Susquehanna, from the end of the said eastern section, to a point opposite the town of Northumberland. And the said board, after taking into view the relative advantages, facilities, costs of construction, and interest

of the commonwealth, shall decide whether the said canal shall be located on the eastern or western side of the said Susquehanna river; or if said commissioners should be of opinion that any part of said canal could be carried along the eastern shore of the aforesaid river, to any point between the end of the eastern section and a point opposite the town of Northumberland, they may so locate and contract for said canal and locks, and are authorized to pass to the other side of the river at any point they may deem proper, in the manner now contemplated of passing the river at or near the mouth of the Juniata.

Section 13. That the canal commissioners be, and they are hereby authorized and required to examine the proposed route of the Schuylkill and Delaware canal, commencing in the vicinity of the United States Arsenal, upon the east bank of the Schuylkill, and terminating at the river Delaware, at the south of the Navy Yard, in the district of Southwark, in the county of Philadelphia, and make report to the legislature at its next session, whether the said route will form a necessary link in the line of the Pennsylvania canal, connecting the western waters with the river Delaware; and if so, to furnish an estimate of the probable cost of constructing said canal.

Section 14. That the provisions of the act entitled "An Act to provide for the commencement of a Canal, to be constructed at the expense of the State, and to be styled The Pennsylvania canal," shall be in force so far as they are applicable to this act; and so much of the laws relating to the Pennsylvania canal, as is inconsistent with this act, is hereby repealed.

Section 15. That the governor be and he is hereby authorized to borrow on the credit of the commonwealth, a sum or sums in the whole not exceeding one million of dollars; and the said sum or sums so borrowed shall be paid to and vested in the commissioners of the internal improvement fund, to be applied by them in the manner and for the purposes hereinafter directed: *provided,* That no engagement or contract shall be entered into which shall preclude the commonwealth from reimbursing any sum or sums thus borrowed, at any time after the expiration of twenty-three years from the first of December next.

Section 16. That the governor be and is hereby authorized to cause to be instituted, certificates of stock, signed by the auditor general, and countersigned by the state treasurer, setting forth that they pertain to the canal loan, for the sum so borrowed by virtue of this act, or for any part thereof, bearing an interest not exceeding five per cent. per annum, and reimbursable as aforesaid, which stock thus created, shall be transferable on the books of the auditor general, or at the Bank of Pennsylvania, by the owner or owners of the same, his, her or their attorney, and new certificates of the same shall be issued by the auditor general and state treasurer, to the new holder or holders; and it is hereby further declared, that it shall be deemed to be a good execution of the said power to borrow, for the governor of this commonwealth to cause the said certificates of stock, or any part thereof, to be sold.

Section 17. That there shall be paid by the state treasurer, to the commissioners of the internal improvement fund, during the current year, and during each and every year from and after the first day of December next, out of the receipts of duties on auctions, such sum or sums as may be necessary to pay the interest on the loans authorized by this act. And the faith of the state is hereby pledged to establish a sufficient revenue for making up any deficiency that may hereafter take place in the funds appropriated for paying the said interest.

Section 18. That it shall be the duty of the commissioners of the internal improvement fund, to cause to be paid out of the moneys borrowed in pursuance of the fifteenth section of this act, such sum or sums as shall be necessary for the completion of the two divisions of the Pennsylvania canal already located, as well as such other sum or sums as may be necessary for the prosecution of the canals and public works authorized to be constructed by this act. And all such sums shall be drawn and accounted for according to the provisions of an act entitled "An act to provide for the commencement of a canal, to be constructed at the expense of the state, and to be styled the Pennsylvania canal," passed the twenty-fifth day of February, one thousand eight hundred and twenty-six; and also an act entitled "An act authorizing a loan for the commencement of the construction of the Pennsylvania canal and for other purposes," passed the first day of April, one thousand eight hundred and twenty-six.

Section 19. That the state treasurer for the time being shall be the treasurer of the internal improvement fund, and shall perform all the duties pertaining thereto, and all such moneys belonging to the said fund, as the commissioners of said fund may deem proper, shall be deposited in the Bank of Pennsylvania, subject to their drafts.

Section 20. That in case any contract for work on the canals authorized by this act, shall be forfeited or abandoned by the contractor or contractors, the acting canal commissioners may re-let the same, without giving notice in the newspapers, as required by the sixth section of the act passed the twenty-fifth day of February, eighteen hundred and twenty-six, entitled "An act to provide for the commencement of a canal, to be constructed at the expense of the state, and to be styled the Pennsylvania canal."

Appendix VI.—*Financial Statement of the Public Works.*

Statement of the cost, revenues and expenditures of the several finished lines of Canals and Railroads of the State Works of Pennsylvania for each financial year, from their opening until disposed of to an Incorporated Company.*

* As to just what is meant in the following tables by "Original Cost." "Cost" and "Expenditures" refer to pages 228 and 238–9.

MAIN LINE.

1. Philadelphia and Columbia Railroad.

Original cost, $3,330,127.55. Cost, $5,277,278.00.

Year	Revenue	Expenditure	Year	Revenue	Expenditure
1833	$ 5,003	None	1846	$488,243	$219,752
1834	40,240	"	1847	564,356	246,377
1835	183,610	$163,691	1848	554,191	261,409
1836	260,658	288,389	1849	571,589	322,904
1837	353,566	403,997	1850	621,576	340,804
1838	390,636	197,201	1851	653,268	338,959
1839	389,974	264,287	1852	820,640	320,887
1840	445,552	550,238	1853	716,242	422,631
1841	411,537	339,170	1854	821,525	390,761
1842	345,082	340,208	1855	857,059	442,138
1843	369,496	288,503	1856	953,034	448,557
1844	416,318	261,382	1857	648,655	368,101
1845	418,502	209,596			79,906*
				$12,300,552	$7,509,846
				7,509,846	

Excess of Revenue.....$ 4,790,706

2. Eastern Division of Canal.

Original cost, $1,347,014.40. Cost, $1,737,285.00.

Year	Revenue	Expenditure	Year	Revenue	Expenditure
1830	$ 10,356	$ 7,761	1845	$117,363	$25,593
1831	17,685	10,895	1846	126,725	69,983
1832	20,599	8,688	1847	160,653	46,844
1833	49,737	19,633	1848	161,856	21,953
1834	79,260	18,657	1849	196,456	43,616
1835	142,854	19,274	1850	190,596	31,941
1836	158,971	16,472	1851	117,723	60,626
1837	136,379	49,300	1852	129,708	46,773
1838	122,746	94,938	1853	141,854	53,183
1839	166,564	32,142	1854	133,726	51,294
1840	165,383	63,403	1855	132,048	59,448
1841	140,188	35,188	1856	151,664	54,577
1842	117,189	27,884	1857	55,632	43,351
1843	108,748	30,693			
1844	152,969	27,485		$3,405,632	$1,071,595
				1,071,595	

Excess of Revenue $2,334,037

*Damages by sparks from locomotives.

3. Juniata Division of Canal.

Original cost, $3,036,290.13½. Cost, $3,575,966.

Year	Revenue	Expenditure	Year	Revenue	Expenditure
1830	None	$ 17,323	1844	$88,649	$ 53,210
1831	$ 4,492	53,172	1845	70,379	63,773
1832	7,205	31,645	1846	78,007	52,755
1833	15,331	34,303	1847	67,312	59,957
1834	56,139	35,298	1848	61,164	224,439
1835	70,078	41,722	1849	68,793	94,544
1836	56,862	33,971	1850	68,000	93,246
1837	79,486	46,865	1851	63,484	93,940
1838	71,327	38,874	1852	65,002	89,186
1839	75,140	41,818	1853	59,478	100,356
1840	106,327	111,772	1854	49,327	90,112
1841	88,178	53,660	1855	48,383	85,493
1842	87,838	88,385	1856	45,487	85,115
1843	87,768	58,363	1857	21,552	94,535
					338,108*
				$1,661,218	$2,305,942
					1,661,218

Excess of Expenditure ..... $ 644,724

4. Allegheny Portage Railroad.

Original cost, $1,634,357.69. Cost, $2,708,672.

Year	Revenue	Expenditure	Year	Revenue	Expenditure
1834	None	$ 5,482	1846	$200,343	$130,321
1835	$ 97,740	98,744	1847	232,587	160,290
1836	153,171	132,538	1848	219,143	220,181
1837	148,523	158,038	1849	218,470	205,702
1838	153,069	148,648	1850	242,521	329,025
1839	151,330	141,857	1851	234,532	341,325
1840	167,266	267,333	1852	210,011	336,007
1841	145,435	133,799	1853	224,627	507,508
1842	116,349	120,175	1854	78,025	338,391
1843	175,476	159,920	1855	18,150	256,458
1844	169,603	208,137	1856	20,047	193,804
1845	160,212	189,757	1857	11,982	82,850
					23,951†
				$3,648,611	$4,890,241
					3,648,611

Excess of Expenditure $1,241,630

*Cost of repairing the Huntingdon breach of 1838.

†Damages by sparks from locomotives.

5. Western Division of Canal.

Original cost, $2.758,917.71. Cost, $3,173,434.

Year	Revenue	Expenditure	Year	Revenue	Expenditure
1830	$ 15,393	$ 55,642	1844	$115,322	$43,625
1831	12,999	66,901	1845	144,580	18,839
1832	9,313	144,323	1846	141,497	27,160
1833	25,437	59,631	1847	205,514	25,258
1834	60,746	83,508	1848	188,296	66,325
1835	103,390	59,754	1849	183,412	63,762
1836	123,228	30,163	1850	219,908	44,403
1837	132,523	75,769	1851	160,055	59,611
1838	108,760	63,838	1852	127,054	64,376
1839	146,480	23,941	1853	161,278	78,975
1840	123,356	92,937	1854	96,407	75,309
1841	117,049	43,743	1855	62,577	72,294
1842	87,218	25,952	1856	52,741	58,322
1843	99,603	22,098	1857	24,442	50,913
				$3,048,578	$1,597,372
				1,597,372	
			Excess of Revenue	$1,451,206	

6. Summary of Main Line.

Original cost	$12,106,707.48½
Cost	16,472,635.00
Revenue	24,064,591.00
Expenditure	17,374,996.00
Excess of Revenue	$6,689,595.00

Lateral Canals.

1. Delaware Division of Canal.

Original cost, $1,238,027.69. Cost, $1,543,763.00.

Year	Revenue	Expenditure	Year	Revenue	Expenditure
1830	None	$ 9,365	1845	$111,452	$39,951
1831	$ 899	76,525	1846	164,203	44,019
1832	8,043	51,715	1847	164,153	16,187
1833	44,825	78,354	1848	180,223	19,539
1834	57,135	46,049	1849	202,505	28,053
1835	56,281	27,493	1850	200,719	43,265
1836	57,175	40,630	1851	256,213	49,357
1837	90,155	28,096	1852	260,037	40,697
1838	72,133	39,782	1853	247,919	86,847
1839	98,240	82,410	1854	377,663	75,979
1840	111,735	85,759	1855	392,673	71,091
1841	64,975	109,339	1856	349,922	83,159
1842	73,228	145,493	1857	224,329	60,730
1843	109,845	17,505	1858	32,141	26,117
1844	114,556	49,044			
				$4,123,377	$1,573,560
				1,573,560	
			Excess of Revenue	$2,549,817	

2. Susquehanna Division of Canal.

Original cost, $1,039,257.00. Cost, $1,039,257.00.*

Year	Revenue	Expenditure	Year	Revenue	Expenditure
1830	None	$ 8,379	1845	$21,214	$26,514
1831	$ 2,215	16,322	1846	23,632	43,513
1832	5,748	65,656	1847	25,909	18,944
1833	7,671	77,094	1848	26,262	15,230
1834	16,431	43,278	1849	27,264	11,646
1835	16,083	12,967	1850	26,073	14,406
1836	13,029	2,155	1851	32,422	23,368
1837	16,296	10,321	1852	33,549	32,077
1838	20,791	17,702	1853	38,928	25,620
1839	22,269	4,201	1854	42,236	27,747
1840	30,129	32,886	1855	75,623	39,664
1841	26,692	17,084	1856	64,662	45,234
1842	17,460	42,435	1857	59,368	52,978
1843	10,775	22,001	1858	6,712	25,114
1844	19,652	32,704			
				$724,092	$806,640
					724,092
			Excess of Expenditure		$ 82,548

*See Rep. Canal Commissioners, in J. H. Rep., 1830-1, II, p. 164.

3. North Branch Division of Canal.

Original cost, $1,398,412.77. Cost, $1,623,117.00.

Year	Revenue	Expenditure	Year	Revenue	Expenditure
1830	None	$ 15,277	1845	$ 80,219	$35,060
1831	"	49,067	1846	89,269	30,347
1832	"	27,654	1847	124,184	36,279
1833	$ 3,416	23,217	1848	120,842	11,505
1834	3,915	48,083	1849	116,552	22,182
1835	5,721	24,662	1850	102,026	26,233
1836	9,824	9,528	1851	149,683	26,497
1837	10,850	13,412	1852	136,621	28,962
1838	8,816	15,903	1853	234,590	26,889
1839	10,181	11,810	1854	225,972	45,245
1840	14,165	110,079	1855	251,992	47,699
1841	29,669	79,425	1856	270,355	53,293
1842	39,590	84,075	1857	162,081	57,377
1843	33,094	28,814	1858	17,321	26,573
1844	51,031	29,234			
				$2,301,979	$1,044,381
				1,044,381	
			Excess of Revenue	$1,257,598	

4. West Branch Division.

Original cost, $1,580,351.84. Cost, $1,833,183.00.

Year	Revenue	Expenditure	Year	Revenue	Expenditure
1830	None	$ 2,166	1845	$29,477	$15,802
1831	"	21,270	1846	45,156	22,762
1832	"	25,866	1847	43,329	18,989
1833	"	28,116	1848	38,578	58,827
1834	"	30,158	1849	43,820	70,247
1835	$ 5,496	26,000	1850	42,500	31,672
1836	3,992	36,116	1851	52,642	30,398
1837	4,708	32,443	1852	55,951	33,844
1838	9,300	39,199	1853	68,329	54,206
1839	12,852	19,834	1854	62,816	29,798
1840	28,003	72,926	1855	86,961	36,109
1841	24,952	57,782	1856	91,688	29,249
1842	16,043	38,663	1857	64,035	87,068
1843	18,518	33,148	1858	14,160	30,269
1844	29,689	30,768			
				$892,995	$1,043,695
					892,995
			Excess of Expenditure		$ 150,700

5. Beaver Division.

Original cost, $481,282.98. Cost, $519,364.

Year	Revenue	Expenditure
1834	$ 555	None
1835	2,221	$ 3,194
1836	504	32,265
1837	1,784	28,199
1838	1,202	11,139
1839	2,032	7,140
1840	3,192	49,740
1841	6,379	24,873
1842	6,580	12,084
1843	6,076	10,369
1844	6,536	27,385
1845	1,251	3,972
	$38,312	$210,360
		38,312
Excess of Expenditure		$172,048

6. French Creek Division.

Original cost, $734,662.06. Cost, $817,779.00.

Year	Revenue	Expenditure
1830	None	$ 2,060
1831	"	None
1832	"	"
1833	"	7,913
1834	$ 336	17,539
1835	884	19,100
1836	388	30,229
1837	1,079	19,065
1838	555	10,107
1839	981	4,060
1840	645	16,263
1841	340	8,383
1842	516	4,585
1843	None	2,592
1844	"	796
1845	97	1,219
	$5,820	$143,912
		5,820
Excess of Expenditure		$138,092

7. Summary of Lateral Canals.

Original cost	$6,471,994.34
Cost	7,376,463.00
Revenue	8,086,575.00
Expenditure	4,822,548.00
Excess of Revenue	$3,264,027.00

Here follow statements of certain costs or expenditures on account of the public works not included in the foregoing tables. (See p. 239.)

Unfinished Improvements.

North Branch Extension of Canal	$4,681,542
West " " "	353,575
Erie Extension of Canal	3,196,149
Wiconisco Canal	393.441
Allegheny Feeder	31,592
Gettysburg Extension of Railroad	682,846
Total	$9,339,145

Board of Canal Commissioners.

1830	$ 3.590	1845	$5,163
1831	4,974	1846	5,042
1832	6,001	1847	5,056
1833	5,740	1848	5,467
1834	6,077	1849	4,930
1835	6,148	1850	5,397
1836	4,075	1851	8,911
1837	10,343	1852	8,569
1838	6,363	1853	7,790
1839	2,036	1854	5,818
1840	8,623	1855	7,230
1841	17,276	1856	8,036
1842	10,747	1857	8,240
1843	4,445	1858	9,963
1844	10,560		
	Total		$202,620

BOARD OF APPRAISERS OF DAMAGES.

1830	$ 192
1831	663
1832	495
1833	1,837
1834	90
1835	3,786
1836	1,014
1837	1,286
1838	885
1839	1,265
1840	3,650
1841	828
1842	960
1843	634
Total	$17,585

COLLECTORS, WEIGHMASTERS AND LOCKKEEPERS.

1830	$ 9,880	1845	$ 68,844
1831	9,032	1846	68,127
1832	22,232	1847	67,426
1833	30,661	1848	73,177
1834	41,722	1849	78,886
1835	54,996	1850	83,305
1836	54,674	1851	90,226
1837	68,632	1852	95,539
1838	65,566	1853	96,870
1839	78,078	1854	95,897
1840	79,571	1855	89,974
1841	89,112	1856	119,239
1842	80,796	1857	70,393
1843	69,557	1858	13,224
1844	63,882		
Total			$2,109,518

EXPLORATORY SURVEYS.

1825	$ 6,351
1826	6,576
1827	15,033
1828	29,881
1829	19,638
1836	500
1837	16,745
1838	2,288
1839	15,826
1840	44,999
Total	$157,837

RECAPITULATION.

Condensed tabular view of the financial operations of the state works of Pennsylvania covering the whole period of state ownership.

LINES.	Cost.	Revenue.	Expenditure.
Columbia and Philadelphia Railroad	$ 5,277,278	$12,300,552	$ 7,509,846
Eastern Division of Canal	1,737,285	3,405,632	1,071,595
Juniata Division of Canal	3,575,966	1,661,218	2,305,942
Allegheny Portage Railroad	2,708,672	3,648,611	4,890,241
Western Division of Canal	3,173,434	3,048,578	1,597,372
Main Line	$16,472,635	$24,064,591	$17,374,996
Delaware Division of Canal	1,543,763	4,123,377	1,573,560
Susquehanna Division of Canal	1,039,257	724,092	806,640
North Branch Division of Canal	1,623,117	2,301,979	1,044,381
West Branch Division of Canal	1,833,183	892,995	1,043,695
Beaver Division of Canal	519,364	38,312	210,360
French Creek Division of Canal	817,779	5,820	143,912
Lateral Lines	$ 7,376,463	$ 8,086,575	$ 4,822,548
Finished Lines	$23,849,098	$32,151,166	$22,197,544
Unfinished Improvements	9,339,145	2,432	
Board of Canal Commissioners	101,310		101,310
Board of Appraisers of Damages	17,585		
Collectors, Weighmasters and Lockkeepers			2,109,518
Exploratory Surveys	157,837		
Old Claims on Public Works (1859)			10,650
Amount received at State Treasury for sale of public property belonging to the State Works previous to the sale of the main line, together with amount received from canal fines, and not included in the foregoing tables of revenues		351,955	
Bills clearly chargeable to the public improvements but included in accounts for State printing, at least			33,803
Paid for use of patent rights			6,400
Amount paid for engraving plates and printing bonds, advertising loans, counsel fees, and other incidental items regarding the internal improvements (approximately)			12,000
	$33,464,975	$32,505,553	$24,471,225
Amount received for works sold,			
(a) Main Line		7,500,000	
(b) Lateral Lines		3,781,000	
Amount paid for interest on loans pertaining to the improvements including premiums on specie funds and interest to domestic creditors			43,675,034
Totals	$33,464,975	$43,786,553	$68,146,259

Appendix VII.—*Tables of Loans.*

Table '*A*' shows the loans of Pennsylvania and under what laws negotiated from the commencement of the internal improvement system in 1826 until June, 1844; the rate of interest at which each was taken; and the premiums received.

Table '*B*' shows the loans made by Pennsylvania from 1844 until the sale of the public works.

'*A*'—*Loans between 1826 and 1844.*

Loans.	Amount.	Rate of Int.	Premiums.
Stock Loan, per act, April 1, 1826	$ 300,000.00	5%	$ 10,875.00
Stock Loan, April 9, 1827	1,000,000.00	5	47,500.00
Stock Loan, March 24, 1828	2,000,000.00	5	
Temporary Loan, April 14, 1828	490,000.00	5	
Stock Loan, Dec. 18, 1828	800,000.00	5	
Temporary Loan, Dec. 18, 1828	225,000.00	5	
Temporary Loan, April 22, 1829	1,518,838.92	5	
Stock Loan, April 22, 1829	2,200,000.00	5	
Temporary Loan, Nov. 17, 1829	1,000,000.00	5	
Stock Loan, per acts, Dec. 7, 1829 and Jan. 4, 1831	487,034.46	5	
Stock Loan, March 13, 1830	4,000,000.00	5	220,000.00
Temporary Loan, Jan. 12, 1831	250,000.00	5	
Temporary Loan, anticipating next loan	230,000.00	5	
Stock Loan, March 21, 1831	2,483,161.88	5	148,989.71
Stock Loan, March 30, 1831	300,000.00	5	18,000.00
Temporary Loan, March 9, 1832	75,000.00	5	
Stock Loan, March 30, 1832	2,348,680.00	5	330,694.14
Stock Loan, April 5, 1832	300,000.00	5	45,270.00
Stock Loan, Feb. 16, 1833	2,540,661.44	5	246,530.97
Stock Loan, March 27, 1833	530,000.00	5	74,200.00
Temporary Loan, Jan. 27, 1834	300,000.00	5	
Stock Loan, April 5, 1834	2,265,400.00	5	99,249.62
Temporary Loan, Jan. 17, 1835	250,000 00	5	
Temporary Loan, Feb. 27, 1835	144,900.00	5	
Stock Loan, April 13, 1835	959,600.00	5	115,343.92
Temporary Loan, Jan. 22, 1836	350,000.00	5	
Temporary Loan, April 1, 1836	55,000.00	4	
Temporary Loan, June 10, 1836	20,000.00	4	
Temporary Loan, June 16, 1836	200,000.00	4	
Temporary Loan, April 14, 1838	200,000.00	4	
Temporary Loan, April 14, 1838	600,000.00	4	
Stock Loan, Jan. 26, 1839	1,200,000.00	5	1,500.00
Temporary Loan, Jan. 30, 1839	602,250.00	5	
Stock Loan, Feb. 9, 1839	1,280,000.00	5	
Temporary Loan, Mar. 14, 1839	75,000.00	5	
Stock Loan, Mar. 16, 1839	100,000.00	5	
Stock Loan, Mar. 27, 1839	470,000.00	5	587.50
Stock Loan, June 7, 1839	50,000.00	5	
Stock Loan, June 27, 1839	1,135,000.00	5	
Temporary Loan, June 27, 1839	220,000.00	5	
Stock Loan, July 19, 1839	2,054,000.00	5	
Stock Loan, Jan. 23, 1840	870,000.00	5	
Stock Loan, April 3, 1840	870,076.66	5	
Stock Loan, June 11, 1840	1,946,215.65	5	
Stock Loan, Jan. 16, 1841	800,000.00	6	37.50
Stock Loan, for insane asylum, Mar. 4, 1841	22,335.06	6	
Amount carried forward	$40,118,154.07		$1,358,778.36

'A'—Loans between 1826 and 1844.—Continued.

Loans.	Amount.	Rate of Int.	Premiums.
Amount brought forward	$40,118,154.07		$1,358,778.36
Loan (Relief), May 4, 1841	2,220,264.68	1	
Stock Loan (Bank Charter), May 5, 1841	569,503.50	5	
Stock Loan (Bank Charter), May 6, 1841	874,077.40	6	
Stock Loan for the Eastern Penitentiary per acts of Mar. 28, 1831 and April 9, 1833	120,000.00	5	
Stock Loan for the Union Canal Company per acts of Mar. 1, 1833 and Dec. 16, 1833	200,000.00	4½	
Certificates of Stock for interest due Aug. 1, 1842, per act, July 27, 1842	866,625.53	6	
Certificates of Stock for guaranty of interest due Bald Eagle and Spring Creek Navigation Company, per act of July 27, 1842	5,000.00	6	
Certificates of Stock for interest due Danville and Pottsville Railroad Company, per act of July 27, 1842	15,000.00	6	
Certificates of Stock for interest due Feb. 1 and Aug. 1, 1843, per act, Mar. 7, 1843	1,747,976.00	6	
Stock Loan for funding of interest certificates and other purposes, April 29, 1844	60,643.72	6	
Certificates of Stock for interest, May 31, 1844	288,506.04	6	
Total	$47,085,750.94		$1,358,778.36

All of the above temporary loans were promptly reimbursed so that none were outstanding in 1844. Usually they had been contracted in anticipation of long time loans.

On January 6th, 1842, the amount of the state debt contracted solely for public works was $33,359,313. After this date the cause for the increase of debt is stated in each case.

'B'—Loans between 1844 and 1858.

Loans.	Amount.	Rate of Int.
Stock Loan for funding interest certificates, April 16, 1845	$5,000,000.00	5
Stock Loan, to renew charter loan, Jan. 22, 1847	62,500.00	5
Stock Loan, for refunding relief notes, April 11, 1848	149,838.45	6
Stock Loan, to avoid Schuylkill inclined plane, April 10, 1849	400,000.00	6
Stock Loan to complete North Branch Extension, April 2, 1852	850,000.00	4½ & 5
Stock Loan, to redeem State stocks, interest certificates, domestic creditor certificates, etc., May 4, 1852	5,000,000.00	4 & 5
Stock Loan to redeem maturing bonds, April 19, 1853	500,000.00	5
Total	$11,962,338.45	

BIBLIOGRAPHY.

Adams, H. C., Public Debts. New York, 1887.

Address to the Citizens of the Commonwealth of Pennsylvania by a Committee of the Pennsylvania Society for the Promotion of Internal Improvements in the Commonwealth. Philadelphia, 1825.

Allegheny Portage Railroad, Reports of, 1844–57, in Executive Documents.

American Almanac, and Repository of Useful Knowledge. Boston, 1830–61.

American Railroad Journal, New York, 1832, 33, et seq.

Andrews, I. DeW., Report on the Trade and Commerce of the British North American Colonies, and upon the Trade of the Great Lakes and Rivers. Washington, 1853.

Annual Report of the Secretary of Internal Affairs of Pennsylvania, Part IV, 1900. Harrisburg, 1900.

Armor, W. C., Lives of the Governors of Pennsylvania. Philadelphia, 1872.

Auditor General of Pennsylvania, Annual Reports on the Finances.

Auditor General, Reports Concerning the Several Railroad Companies, 1861–65.

Baker, G. W., Review of the Relative Commercial Progress of the Cities of New York and Philadelphia. Philadelphia, 1859.

Board of Canal Commissioners of Pennsylvania, Reports of, 1825–59.

Bourne, E. G., History of the Surplus Revenue of 1837. New York, 1885.

Breck, Samuel, Sketch of Internal Improvements already made by Pennsylvania. Philadelphia, 1818.

Brigham, A. P., The Great Roads across the Appalachians, in Bulletin Amer. Geog. Soc., June, 1905.

Brightly, F. C., Digest of the Laws of Pennsylvania, 1700–1853, eighth edition. Philadelphia, 1856.

Callender, G. S., The Early Transportation and Banking Enterprises of the States in Relation to the Growth of Corporations. Q. J. Ec., XVII, 1902.

Canal Policy of Pennsylvania, Strictures, by a Citizen. 1832.

Carey, Mathew, Brief View of the System of Internal Improvements of the State of Pennsylvania. Philadelphia, 1831.

Census Reports, United States.

Chevalier, M., Society, Manners and Politics in the United States. Boston, 1839.

Clark, J. A., Wyoming and Lackawanna Valleys. Scranton, Pa., 1875.

Clarke, T. E., Avenues of Western Trade. Hunt's Mer. Mag., XXXV, 1856.

Cleveland, F. A., Railroad Finance. New York, 1904.

Commissioner of Internal Improvement Fund of Pennsylvania, Reports of, 1827–45.

Connected View of the Whole Internal Navigation of the United States, by a Citizen of the United States. Philadelphia, 1830.

Constitution of the Pennsylvania Society for the Promotion of Internal Improvements in the Commonwealth.

Cornell, W. M., History of Pennsylvania. Philadelphia, 1876.

Derby, E. H., Agriculture and the Influence of Manufactures and Public Improvements on Agriculture. Hunt's Mer. Mag., XVII, 1847.

Dewey, D. R., Financial History of the United States. New York, 1903.

Documents Referring to the Controversy between the Canal Commissioners of the State of Pennsylvania and the Harrisburg and Lancaster and the Pennsylvania Railroad Companies with Remarks upon the Relative Position of the State Improvements and the Pennsylvania Railroad. Philadelphia, 1852.

Executive Documents, 1843–60. Prior to 1843, published with House and Senate Journals.

Facts and Arguments in Favor of Adopting Railways in Preference to Canals in the State of Pennsylvania. (Anonymous.) Philadelphia, 1825.

Ferree, B., Pennsylvania: A Primer. New York, 1904.

First Annual Report of the Acting Committee of the Society for the Promotion of Internal Improvements in the Commonwealth of Pennsylvania. Philadelphia, 1826.

Flagg, A. C., The Rise, Progress and Present Condition of Internal Improvements in the State of New York. Hunt's Mer. Mag., Sept., 1850, et seq.

Gallatin, A., Report of the Secretary of the Treasury on Public Roads and Canals. Washington, 1808.

General Statement of the Contracts for Opening and Improving Roads and Rivers. Philadelphia, 1797.

Governors' Messages.

Hammond, J. W., A Tabular View of the Financial Affairs of Pennsylvania, 1826–44. Philadelphia, 1844.

Hazard, S., The Register of Pennsylvania, Jan. 5th, 1828,—Dec. 26th, 1835. Philadelphia, 1828–36.

History of the Ohio Canals. Pub. Ohio State Archaeological and Historical Society. Columbus, 1905.

Hulbert, A. B., The Great American Canals. 2 vols. Cleveland, O., 1904.

Hulbert, A. B., Washington and the West. New York, 1905.

Inland Navigation and Internal Improvements as Now Prosecuted in Pennsylvania, by a Freeholder of Franklin County. Chambersburg, 1829.

Johnson (Attorney General), Compilation of the Laws of Pennsylvania Relative to the Internal Improvements; together with the Canal and Railway Regulations, as Established by the Board of Canal Commissioners. Harrisburg, 1840.

Journals of the House of Representatives of Pennsylvania.

Journals of the Senate of Pennsylvania.

Keith, H. E., Historical Sketch of Internal Improvements in Michigan, 1836–48. Pub. Mich. Pol. Sci. Ass'n., IV. 2, 1900.

Klein, T. B., The Canals of Pennsylvania and the System of Internal Improvements of the Commonwealth. Report of Pennsylvania Secretary of Internal Affairs, 1900.

Laws of Pennsylvania. Those before 1778 are found only in manuscript.

Laws of Pennsylvania, General Index to, 1700–1812. Philadelphia, 1812.

Legislative Documents, 1854–60. Prior to 1854, published with House and Senate Journals.

Letters on the Subject of the Sale of the Main Line of the Public Improvements owned by the Commonwealth of Pennsylvania, by a Citizen of Adams County. Philadelphia, 1857.

McPherson, E., Letters of a Pennsylvanian on the State Canals. Harrisburg, 1858.

Merchants' Magazine and Commercial Review (many volumes). New York, 1840, 41, et seq.

Monongahela Navigation Company's Reports, 1851–53. Harrisburg, 1853.

Mead, B. M., Brief Review of the Financial History of Pennsylvania, 1682–1881. Harrisburg, 1881.

Newspapers, contemporary ones. Butler Repository, Erie Gazette, Franklin Repository, Harrisburg Chronicle, Miners' Journal of Pottsville, Schuylkill County, Pennsylvania Inquirer, United States Gazette, and others.

Niles' Weekly Register (many volumes). Baltimore, 1811, 12, et seq.

Philadelphia and Columbia Railroad, Reports of, 1844–57, in Executive Documents.

Pickell, J., A New Chapter in the Early Life of Washington. New York, 1856.

Poor, H. V., Manual of the Railroads of the United States (especially for the years 1868 and 1881). New York, 1868, 69, et seq.

Poor, H. V., Railways of the United States. Vol. I. New York, 1860.

Publius, Letters to the Members of the Pennsylvania Legislature on the Subject of the State Debt. Philadelphia, 1844.

Report made by Commissioners Who Explored and Surveyed the Eastern and Western Waters of the State of Pennsylvania, 1789–1793. Published in the Appendix to the Journal of the House of Representatives of Pennsylvania, 1815–16.

Report of Commissioners Appointed March 21st, 1823, to Visit and Examine all the Contemplated Routes for Connecting the Waters of Lake Erie and French Creek by Canal and Slack Water Navigation. Harrisburg, 1824.

Report of Commissioners Appointed to Explore the River Susquehanna. Harrisburg, 1823.

Reports of Committees, House of Representatives, Congress U. S., 1st Session, 19th Congress, 1826. Report No. 128. Washington, D. C.

Report of Committee of the Senate of Pennsylvania upon the Subject of the Coal Trade. Harrisburg, 1834.

Report of Committee of Ways and Means Relative to the Finances. Harrisburg, 1831.

Report of Grand Committee appointed to Investigate the Present System of Internal Improvements in Pennsylvania. Harrisburg, 1833.

Report of a Joint Committee of the Senate and House of Representatives upon the Conduct of the Financial Affairs of the Commonwealth, from 1838 to 1843. Harrisburg, 1878.

Report of Committee to Whom was Referred the Subject of the Juniata and Conemaugh Canal. Harrisburg, 1824.

Report of Select Committee Appointed to Inquire into the System of Management of the Philadelphia and Columbia and Allegheny Portage Railroads. Harrisburg. (n. d.)

Report of Select Committee of the Senate on the Sale of the Public Works. Harrisburg, 1854.

Report of Senate Committee on Foreign Corporations. Harrisburg, 1825.

Report on How to Avoid the Schuylkill Inclined Plane, in Executive Documents, 1848, 1849 and 1853.

Report on Roads, Bridges and Canals. Senate Document. Harrisburg, 1822.

Report upon the Finances and Internal Improvements of the State of New York. Boston, 1838.

Ringwalt, J. L., Development of Transportation Systems in the United States. Philadelphia, 1888.

Roberts, S. W., Reminiscences of the First Railroad Over the Allegheny Mountain, in Penn. Hist. Mag., II, Philadelphia, 1878.

Robertson, J., A Few Months in America. London, 1855.

Russell, R., North America, its Agriculture and Climate. Edinburgh, 1857.

Scott, E. A., Memoir of Charles E. Smith. Buffalo, 1902.

Scott, J. W., Our American Lake Cities. Hunt's Mer. Mag., XXXI, Oct., 1854.

Scribner's Statistical Atlas of the United States. New York, 1883.

Sipes, W. B., The Pennsylvania Railroad. Philadelphia, 1875.

Smith's Laws of Pennsylvania. (Several volumes.) Philadelphia, 1810.

State Engineer's Reports, in Executive Documents, 1856–58.

Statistical Atlas of the United States. Washington, 1903.

Strickland, W., Report on Canals, Railways and Other Subjects. Philadelphia, 1826.

Strong, H. K., Main Line of State Works of Pennsylvania. Hunt's Mer. Mag., XIII, Aug., 1845.

Sullivan, J. L., Suggestions on the Canal Policy of Pennsylvania. Philadelphia, 1824.

Sumner, W. G., Andrew Jackson as a Public Man. Cambridge; 1882.

Tanner, H. S., A Description of the Canals and Railroads of the United States. New York, 1840.

Tower, W. S., Topography and Travel in Pennsylvania, in Bulletin Amer. Geog. Soc., March, 1905.

Trotter, A., Observations on the Financial Position and Credit of such of the States of the North American Union as have Contracted Public Debts. London, 1839.

Tyson, J. R., Letters on the Resources and Commerce of Philadelphia. Philadelphia, 1852.

Vernon, E., American Railway Manual of the United States and Canada. New York and Philadelphia, 1873.

Walker, F. A., Statistical Atlas of the United States based on the Results of the 9th Census, 1870. Washington, 1874.

Wallace, J. W. (?), Pennsylvania as a Borrower. Philadelphia, 1863.

Wilson, W. B., History of the Pennsylvania Railroad Company. 2 vols. Philadelphia, 1899.

Worthington, J. K., Historical Sketch of the Finances of Pennsylvania, in Pub. Amer. Econ. Ass'n., II, 1887–8.

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DECAPOD CRUSTACEA OF BERMUDA; I—BRACHYURA AND ANOMURA. THEIR DISTRIBUTION, VARIATIONS, AND HABITS

BY

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VI.—Decapod Crustacea of Bermuda; I,—Brachyura and Anomura. Their Distribution, Variations, and Habits. By A. E. Verrill.

The following catalogue is intended to include all the species hitherto known to occur at Bermuda. It is based mainly on the collections made by myself and the small parties of students and others who went with me to Bermuda in 1898 and 1901 to make collections for the Museum of Yale University. But I have also used several earlier collections already in the Yale Museum, especially that of Mr. G. Brown Goode, made in 1876–1877, of which the species were mostly determined by Prof. S. I. Smith, soon afterwards; and the still earlier collections sent to the Museum by Mr. J. M. Jones, about 1866 to 1877; also small collections made about the same period by Dr. C. Hartt Merriam, Dr. F. V. Hamlin, and others.

Recently, Professor Trevor Kincaid, of the Washington State University of Seattle, has sent me, for examination, his entire collection, made while at the Bermuda Biological Station, in 1903.

The Field Natural History Museum of Chicago sent to Bermuda, in 1905, an expedition under Dr. Tarleton H. Bean, especially to collect the fishes, but a good collection of Crustacea was also obtained, including a number of species dredged on the Challenger and Argus Banks. This collection has been sent to me for study by the director, Mr. F. J. Skiff, to whom I am much indebted for the privilege of studying it. The collection contained several interesting additions to the Bermuda crustacean fauna.*

Prof. E. L. Mark, of Harvard University, has also kindly sent me, for study, a collection of Crustacea made by the members of the Bermuda Biological Station, under his direction. It is of special interest because some of the species were dredged on the Argus and Challenger Banks, and a few are new to the fauna. Several partial and nominal lists of Bermuda Decapod Crustacea, mostly without descriptions or figures, have already been published, increasing, from time to time, the number of known species, but none are complete. No doubt many additions will also be made hereafter to the present list, though it is probably nearly complete for the shore and shallow water species.

* Among these are *Dromia erythropus*, a small *Munida*, and a small red *Alpheus*, apparently new, from the Banks; *Charybdella tumidula*, Long Bird I., and *Glypturus Branneri* Rath., from St. Davids Island.

The earlier lists, worthy of notice, are those of Mr. J. M. Jones.* The species enumerated by him, merely by names, were identified for him by others, and were not all reliably named. A good series of his Bermuda Crustacea still remains in the Yale Museum, and has been used in preparing this list, as stated above.

Prof. Sidney I. Smith, in a memoir on the Crustacea of Brazil,† in 1869, recorded five species from Bermuda (coll. J. M. Jones) studied by him in the Yale Museum, and others in his later papers.

Prof. Angelo Heilprin, in his general work on the Bermudas,‡ gave a brief list of the Crustacea obtained. They were identified by Mr. Witmer Stone, who was a member of Prof. Heilprin's party. One of his species (*Cyclograpsus integer*) has not been taken by later collectors. A list of nine species was given by Professor Ortmann in the reports of the Plankton Expedition.§

In a general illustrated work on the West Indian Decapod Crustacea,‖ Mr. Young has enumerated and described 23 species pre-

* The Naturalist in Bermuda, London, 1859, 212 pp., 8vo ; The Visitor's Guide to Bermuda, Halifax, New York, and London, 1876, 12mo, 159 pp. For a list of his other writings, see these Trans., vol. xii, p. 201 ; The Bermuda Is., ii, p. 157.

Mr. Jones was a lawyer, resident in Halifax, N. S., but he resided a number of winters in Bermuda, also doing business there. He was much interested in zoölogy, botany, and geology, and did much useful pioneer work there, in those subjects. His books were very useful at the time he wrote, for little had then been published on the natural history of the Bermudas. He devoted more attention to the Mollusca than to any other subject, and made a large collection of shells there, but no complete list of them has been published. He was a personal friend of Governor Lefroy, as shown by their correspondence which I have seen, and they were often associated in making collections. I made his personal acquaintance, while at Halifax, in 1877. Soon after that he sent to the Yale Museum a large part of his collections of corals, echinoderms, bryozoa, etc. At about the same period he sent his collection of Crustacea to be studied by Prof. S. I. Smith of Yale, who was then intending to write a general report on the Bermuda Crustacea for Bulletin 25 of the U. S. National Museum. Other more imperative duties prevented the completion of that work, as well as my own report on the corals and echinoderms, undertaken at the request of Mr. Goode, for that Bulletin.

† Notice of the Crustacea collected by Prof. C F. Hartt, on the Coast of Brazil in 1867. These Trans., vol. ii, pp. 1–42, 1869.

‡ Heilprin, Angelo.—The Bermuda Islands. Crustacea on pp. 146–149. Philadelphia, 1889.

§ Ortmann, Arnold.—Decapoden und Schizopoden der Plankton Exped., Bd. ii, 1893.

‖ Young, Chas. G.—The Stalk-Eyed Crustacea of British Guiana, West Indies, and Bermuda, London, 1900, xix + 514 pp., 7 colored plates.

viously recorded from Bermuda. In the Reports of the Voyage of the Challenger there are lists* of the 25 shallow-water species obtained at Bermuda. Dr. W. M. Rankin, of Princeton University, published in 1900 a much more complete list, including all the species known up to that date.† He recorded 33 species of Brachyura and 6 of Anomura. He utilized the collections made by the parties from the University of New York. He also had, for his use, a list of the species obtained by Mr. G. Brown Goode,‡ in 1876

* Miers, Edw. J.—Report on the Brachyura, vol. xvii, 1886. Henderson, J. R.—Report on the Anomura, vol. xxvii, 1888.

† The Crustacea of the Bermuda Islands, with notes on the Collection made by the New York University Expeditions of 1897 and 1898. Annals New York Acad. Science, vol. xii, No. 12, pp. 521–548.

‡ Mr. G. Brown Goode, who was for many years Assistant on the U. S. Fish Commission; later, Assistant Secretary of the Smithsonian Institution and Director of the National Museum; and at one time Commissioner of Fish and Fisheries; was a prominent ichthyologist. He published a number of important works on fishes. One of his earlier ones was a Catalogue of the Fishes of Bermuda with notes on their colors and habits. (Bulletin of the U. S. National Museum, No. 5, 1876.) He published a more complete catalogue in Bulletin 25, 1884.

He visited Bermuda in the winters of 1876 and 1877, partly for the benefit of his health. While there he made extensive collections, especially of fishes, Crustacea, sponges, corals, and echinoderms. His collections were much larger than any previously obtained there. They contained about 35 species of Brachyura and Anomura; also many Macrura, Amphipods, etc. His corals, actiniæ, echinoderms, bryozoa, etc., were identified by me, before 1880, and studied with reference to the preparation of a faunal report on those groups, for Bulletin 25 of the U. S. National Museum. But this work and several others were laid aside in order to undertake the more important investigation of the deep-sea invertebrate fauna off the American coast, by the U. S. Fish Commission, which was begun in 1880, and placed under my charge by the Commissioner, Professor S. F. Baird. As that work continued annually from 1880 to 1888, and the vast collections obtained were put in my care for study, many of them even to the present time, with scarcely any funds to employ assistants, I have never been able to resume the publication of those Bermuda reports, in the form intended, but the results have, in large part, been included in the papers recently published by me in these Transactions. Although Mr. Goode's collection of Crustacea was the best made up to that date, it was by no means complete.

The following extract from one of Mr. Goode's letters to Professor S. I. Smith will serve to illustrate his interest in collecting the Crustacea:

BERMUDA, March 19, 1877.

My Dear Professor Smith:

"I am making fine hauls among the crustaceans, especially among the minute forms, and have already filled about 125 phials and bottles. Have not yet found

and 1877, which had been identified by Professor S. I. Smith, many years before. A series of the same collection, which was sent to the U. S. National Museum, was studied by Miss Rathbun, who furnished the list for Dr. Rankin. Another series is in the Museum of Wesleyan University. Professor Smith has published measurements and other information in regard to a number of the species in Goode's collection, in several of his papers.

Two papers by me* gave the many additional species obtained by the parties that went with me to Bermuda from Yale University in 1898 and 1901, to study the zoölogy and make more complete collections.

A recent and very important work on the Decapod Crustacea of Porto Rico† has been published by Miss M. J. Rathbun. She has indicated in her report all the species that had been previously recorded from Bermuda, with their general distribution. In that report, brief but clear descriptions are given of all the genera and species, as well as analytical tables of the genera and species. It is, therefore, almost a manual for the Bermuda species, for most of them were also in the Porto Rico collections. For students of these Crustacea it is the most useful of the works readily available. It contains only few figures of the Bermuda species, however.

In the present article I have endeavored to figure as many as possible of the species, even when well known, for such figures greatly facilitate their identification and may largely take the place of descriptions. From this point of view this article may be regarded as a complement to that of Miss Rathbun, to which reference should be made for technical descriptions.

I have, however, included brief descriptions of some of the more difficult species, and also most of the notes that I have on the colors of the living specimens, with such observations on habits as seemed to be of interest. I have also indicated the general distribu-

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the larval stages of any species whatever,—perhaps because I have not had time to use a towing net." * * * *

"Am having excellent success, particularly with fishes and sponges. I have added about 40 species of fishes to my published list. You will be pleased to know that I find *Amphioxus* quite abundantly."

* Additions to the Crustacea and Pycnogonida of the Bermudas, Trans. Conn. Acad. Sci., vol. x, part ii, pp. 573–582, plates lxvii–lxix, 1900.

Additions to the Fauna of the Bermudas from the Yale Expedition of 1901, with Notes on Other Species. Op. cit., vol. xi, pp. 15–62, plates i–ix, 1901.

† Rathbun, Miss Mary J.—The Brachyura and Macrura of Porto Rico. From the U. S. Fish Comm. Bulletin, for 1900, vol. ii, pp. 1–137*, pl. i, ii, 1901.

tion and range of the species. In 1898, one of my sons, Clarence S. Verrill, who was of the Yale party, made notes on the habits and colors of the Crustacea. I am indebted to him for such notes, many of which are here utilized, and have his initials appended.

Another son, A. Hyatt Verrill, made a large collection of Crustacea in March, 1901, before my arrival at Bermuda. He found a number of interesting additions to the fauna. I am also indebted to him for the photographs and drawings used in this paper, and also for a number of colored figures and various notes made on the colors and habits of a number of species. To Miss M. J. Rathbun, whose nomenclature I have generally followed, I am indebted for the identification of many of the smaller and more critical specimens, and for the loan of others. From her papers I have also borrowed, with a few alterations, some of the analytical tables of species, genera, and higher groups.

I am also indebted to Professor S. I. Smith for numerous comparative measurements of a number of species, made by him several years ago for another purpose.

Many of the crabs have colors that are highly protective by day; others have colors that are not protective by daylight, but are highly so at night, in moonlight, or twilight. They afford an excellent field for studies of this kind. Although these Crustacea are numerous in Bermuda, there are many species that are seldom taken by inexperienced collectors, because of their peculiar habits. Many are found concealed beneath large rocks or masses of dead corals, which must be turned over to obtain them. This is particularly true of most of the Pilumnidae, and of *Mithrax forceps*, *Percnon planissimum*, etc. Some live regularly in eroded holes in masses of coral or limestone, like many species of *Alpheus* and the common *Gonodactylus Œrstedi*. The rare crab, *Epialtus bituberculatus*, was found only by breaking up such rocks. Several species are peculiar to the mangrove swamps, and live chiefly among the tangled roots of the mangroves, where it is hard to capture them. The handsomely colored *Goniopsis cruentatus* has this habit, as well as some species of *Sesarma*, *Pachygrapsus*, *Eupanopeus*, etc. The land-crabs, *Gecarcinus* and *Cardisoma*, burrow deeply in the earth, and the same is true of *Ocypode arenarius*, *Hippa cubensis*, etc., which inhabit sandy beaches. These and many others are mainly nocturnal in their habits and can sometimes be caught out of their burrows in the night by means of torches or lanterns, especially in summer. The great *Cardisoma guanhumi* is seldom taken here in any other

way. The various species of Portunidæ are active swimmers in shallow water and must be taken by means of nets. Many species are partial to the outlying reefs, living in holes and crevices, or under broken blocks of stone. A few species have been obtained only by dredging, but so little dredging has hitherto been done, except in very shallow water, that we really know very little about the extensive fauna that undoubtedly inhabits the zone between 10 and 150 fathoms. A few hauls of the dredge were made by the "Challenger" outside the reefs. The expedition sent out by the Field Museum of Chicago, under Dr. Bean, did a small amount of dredging on the Argus and Challenger Banks, and obtained there some interesting additions to the Crustacean fauna, which have been sent to me for study. A few successful hauls were also made there by a party from the Bermuda Biological Station.

Dredging outside the reefs, in 10 to 30 fathoms, where the fauna should be richest, is difficult, not only because of the rough seas that prevail there at the seasons when most collectors visit the islands, but also because the bottom itself is very broken and rough, being covered in most places by large masses of broken rocks and dead corals, and in many localities by living branched corals (*Oculina*) and gorgonians, so that the dredges are apt to be lost or the nets speedily torn. Even tangles are liable to be caught among the rough rocks and lost. The larger Crustacea, living in such places, can only be obtained by means of baited fish-traps or lobster pots. In this way three large species of *Scyllarides* or "Spanish-lobsters" have been obtained, as well as several large crabs. The collections of Crustacea made by my own parties are very much larger than those made by any of the other expeditions, both in the number of species and in the number of specimens, but they were all obtained in the spring, from March 1st to June 4th, and very few were dredged. The same is true of several other collections. Mr. Jones and Mr. Goode collected both in the winter and spring, but the dates are seldom indicated on their labels. The collection from the University of New York, worked out by Dr. Rankin, was made in midsummer, and therefore affords some additional seasonal information. Probably considerable differences would be found between large collections made in midsummer or autumn and those made in winter or spring.

In this respect the collection made by the expedition from the Field Museum of Natural History is of special interest. That party worked from Aug. 18 to Nov. 10, 1905. The collection of

Crustacea obtained is not large, for the fishes were the special objects sought, but it contains many interesting species, some of them not previously found.

Whenever possible I have given the season when females carrying eggs were taken.

Since many species may have been formerly introduced by adhering to the bottoms of vessels, and others may be introduced hereafter in the same way, I have thought it advisable to mention particularly the earlier occurrences of all the species, so far as I know. But very few dates can now be given earlier than those of the collection of J. M. Jones, which was fortunately quite large. Much of his collection was made as early as 1859 to 1866, but his specimens had no labels giving precise dates. Abundant opportunity for the introduction of West Indian species have prevailed for nearly 300 years, but they have much increased in modern times, especially since the establishment of the great naval dry dock. Vast numbers of living marine animals are always scraped from the bottoms of foul vessels, besides barnacles.

BRACHYURA.

*Key to the Superfamilies or Tribes of Brachyura.**

A.—Buccal frame quadrate; efferent branchial channels opening at the sides of the endostome.

B.—Carapace usually quadrilateral, frontal region curved downward. Verges inserted either in the sternal plastron or in the basal joints of the fifth pair of legs of the male, thence passing through channels in the sternum, beneath the abdomen ..... *Catometopa*

B¹.—Carapace not quadrilateral. Verges inserted in basal joints of the fifth pair of legs.

C.—Carapace short and broad, rounded in front, without a projecting frontal rostrum ..... *Cyclometopa*

C¹.—Carapace usually more or less triangular or ovate, with a projecting, pointed, forked, or spined rostrum ..... *Oxyrhyncha*

A¹.—Buccal frame usually triangular, narrowed forward; efferent canals opening at middle of the endostome. Verges inserted in the basal joint of the fifth pair of legs ..... *Oxystomata*

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* Taken with slight alterations from Brachyura and Macrura of Porto Rico, by Miss M. J. Rathbun.

CATOMETOPA.

Family **OCYPODIDÆ** Leach.

This family is represented in Bermuda only by the genus *Ocypode*. The "fiddler-crabs" (genus *Uca* or *Gelasimus*), so abundant on most coasts of warm countries, are entirely lacking, so far as known.

Ocypode arenarius (G. Edw.) Say. *Ghost-Crab; Sprite; Beach Crab.*

Cancer arenarius Edwards in Catesby, Nat. Hist. Carolina, ii, pl. 35, 1771.

Cancer quadratus J. C. Fabricius, Entomologia Systematica, ii, p. 439, 1793. ("Habitat in Jamaica Mus. Dom. Banks.")

Ocypode quadrata J. C. Fabricius, Suppl. Entomol. System., p. 347, 1798. S. I. Smith, Trans. Conn. Acad. Sci., iv, p. 257, 1880. (Synonymy and distr.)

Ocypoda albicans Bosc, Hist. nat. Crust., i, p. 196 (not the fig.) (Carolina coast).

Ocypode arenarius Say, Jour. Acad. Nat. Sci. Philadelphia, i, p. 69, 1817. M.-Edwards, Hist. nat. Crust., ii, p. 44, pl. 19, figs. 13, 14, 1837 (*Ocypoda arenaria*):

Coues, Proc. Acad. Nat. Sci. Philadelphia, 1871, p. 122 (*arenaria*; North Carolina, habits).

Smith, Amer. Jour. Sci. (3), vi, p. 67, 1873 (*Monolepis inermis* = megalops-stage); Inverteb. Vineyard Sd., Report U. S. Fish Comm., i, p. 545 (251). 534 (240), 1874 (*Ocypoda arenaria*).

Kingsley, Proc. Acad. Nat. Sci. Philadelphia, 1878, p. 322 (7), (*Ocypoda arenaria*); op. cit., for 1879, p. 400; op. cit., 1880, p. 184.* Rankin. Crust. Bermuda Is., p. 525, 1900.

Ocypoda rhombea M.-Edwards, Hist. nat. Crust., ii, p. 46, 1837 ("Antilles et Brésil"); Ann. Sci. nat., III, xviii, p. 143 (107), 1852 (*Ocypode*).

Dana, U. S. Expl. Exped., Crust., p. 322, pl. 19, fig. 8, 1852 (Brazil).

Monolepis inermis Say, Jour. Acad. Nat. Sci. Philadelphia, i, p. 157, 1817 (megalops-stage).

Ocypode albicans M. J. Rathbun, Results Branner–Agassiz Exp. Brazil, Proc. Wash. Acad. Sci., ii, p. 134, 1900; Brachy. and Macr. Porto Rico, p. 6, 1901 (descr.); Amer. Naturalist, xxxiv, p. 585, figs. 1, 2, 1900.

FIGURE 1. PLATE IX, FIGURES 2, 3.

This crab is easily distinguished by its thick, quadrate carapace, coarsely granulated on the sides, with finer granules on the middle and posterior parts; the acute anterior angles; and the very large eyes and eye-stalks. The eyes are abruptly rounded distally, but prolonged proximally on the stalks beneath. The chelipeds of the males

* Kingsley, op. cit., p. 184, used the specific name *arenaria*, as from Catesby, 1731 and 1771, dating it from the later edition. That edition was edited by George Edwards, who gave binomial names to the species of Catesby. There is no valid reason for not adopting them when they have priority, as in this case. The name *Cancer arenarius* is given in the text and is also engraved on the plate.

have a stridulating organ, consisting of a vertical series of short raised lines of tubercles on a narrow ridge. It is doubtless used for a sexual call. The ambulatory legs are fringed with long yellow hairs.

The color of the adults at Bermuda, in life, is mostly pale yellow, straw-color, or yellowish white, imitating closely the color of the beaches of yellowish white shell-sand on which it lives. Those

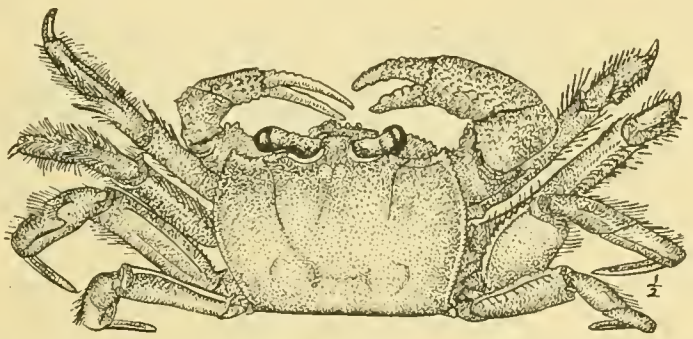

Figure 1.—*Ocypode arenarius*, about $\frac{2}{3}$ nat. size, after photo. by A. H. Verrill.

young specimens that we found living on the coast of New Jersey, in spring, were "pepper-and-salt color," imitating closely the colors of the silicious (granitic) sand of the beaches. When pursued they would run very rapidly, often suddenly stopping and squatting so closely in the sand that they could be easily overlooked.

Its common name, "ghost-crab," alludes both to its pale color and nocturnal habits. It can run very swiftly on the sandy beaches. It lives in deep burrows near or above high tide.

Measurements in millimeters.

Number	Sex	Carapace length	Carapace breadth	Front breadth	Chelæ length	Chelæ height	Eyestalks length	Locality
3060	♀	39	45	5.5	r. 21 l. 36	14 21	16	Bermuda
3154	♂	38	45	5.5	r. 36 l. 45	17 20	16	"
1719	♀	40	50	6.	r. 42 l. 34	22 14	16	Ft. Macon
4063	♂	35	43	5.	l. 38	22	15.5	Bermuda

Its range, in the adult state, is from Virginia to Brazil, but the free-swimming young (*megalops*) are carried much farther north in the Gulf Stream and often arrive alive on the southern coasts of New England.

Prof. S. I. Smith* has recorded the frequent occurrence of the full grown megalops of this species in Long Island Sound and on the

*Amer. Journ. Science (3), vol vi, p. 67, 1875; and Trans. Conn. Acad. Sci., iv, p. 255, 1880.

southern coast of New England, and of the early stages of the adult form, in abundance, on Fire Island Beach, on the south side of Long Island, in September, 1870. Probably it rarely if ever survives the winter so far north. In April, 1872, in company with Professor Smith, I found the young of the previous year abundant and very agile on the outer beaches at Great Egg Harbor, N. J. These had the carapace about 18 to 24^{mm} broad.

At Bermuda we found this crab common on the shell-sand beaches of the south shore, near Tuckers Town and elsewhere, and also on the north shore at Shelly Bay, Long Bird Island and Bailey Bay. One specimen was caught and brought in by a dog, at night. Several large Bermuda specimens in the Yale Museum were collected by Dr. C. Hartt Merriam, April, 1881. Two examples were in Mr. Goode's collection. It has been obtained by several other collectors. The largest that I have seen were obtained at Cooper's Island, by the Field Nat. Hist. Museum Expedition. None of the females that I have seen carried eggs, though they have been taken in spring, midsummer, and autumn. Perhaps the number examined was not large enough to made this negative evidence of much value.

Family **GECARCINIDÆ** M.-Edw. *Land Crabs.*

These land crabs can readily be recognized by their very convex surface, with the margins rounded and dilated over and in front of the branchial regions. The front is strongly bent downward and moderately wide ; orbits and eye-stalks not very large. Chelipeds of the adult males large and powerful, more or less unequal. Distal joints of the legs granulated and fringed.

Gecarcinus lateralis (Frem.) Guerin. *Common Land Crab.*

Ocypoda lateralis Freminville, Ann. Sci. nat., iii, p. 224, 1835.

Gecarcinus lateralis Guerin, Icon. Règne Anim., pl. v, fig. 1. Rankin, Crust. Bermuda, p. 525, 1900.

M. J. Rathbun, Brach. and Macrura Porto Rico, p. 14, 1901.

Verrill, these Trans., vol. xi, p. 706, fig. 57 ; The Bermuda Is., i, p. 294, fig. 57.

Gecarcinus lagostoma (pars) Miers, Voy. Challenger, vol. xvii, p. 218, 1886. Young, Stalk-eyed Crustacea, p. 241, 1900.

Figure 2.

Commonly the carapace, in life, is mostly of a deep reddish brown or plum-color ; often this color is replaced posteriorly by a wide transverse band of lighter color spotted with yellow ; this band extends forward, along each side, becoming narrower and darker, dis-

appearing near the eye-sockets ; a pair of small white spots close behind the eye-sockets and another pair in the cardiac region. Legs light grayish brown ; chelipeds darker and more red ; last joint bright orange. Under side white.—C. S. V.

The color is often more reddish than above described, especially when immature. The youngest individuals were much paler. The dark purple and red colors are protective at night.

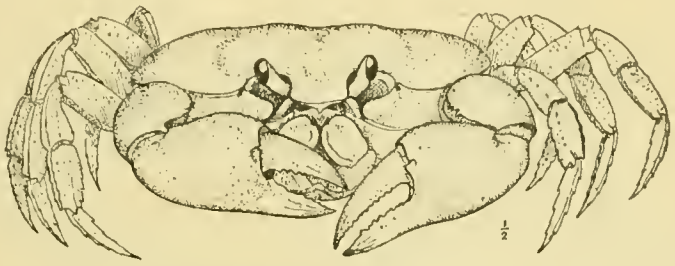

Figure 2.—Land Crab, *Gecarcinus lateralis*, front view, nat. size. Drawing by A. H. V.

It is very common in sandy waste places on many of the smaller islands, especially on those that are uninhabited, or nearly so. It makes its deep burrows both near the shore and on the low hills, 20 to 30 feet high, at some distance from the shore and where the shell-sand was nearly or quite dry. We found them both in open land and among cedar bushes. Its burrows are often very long and deep ; some that we dug out descended obliquely to the depth of 3 to 4 feet or more, and then ran off horizontally 4 to 5 feet, ending in a small chamber. Others, equally large, were quite shallow. Some of the young were exposed by turning over large flat stones, under which they had burrowed. Many burrows were among the tangled roots of cedars, etc., where they could not be dug out.

The largest Bermuda specimen that I have seen was obtained at St. Davids Island by the expedition of the Field Nat. Hist. Museum. They also collected it at Cooper's I. and Castle I. None of the specimens seen carried eggs,* though some were taken in midsummer (Bermuda Biol. Station, Prof. Kincaid).

Measurements in millimeters.

Number	Sex	Carapace length	Carapace breadth	Front breadth	Chelæ length	Chelæ height	Locality
3048.	♂	39	48	10	r. 33 l. 45	r. 15 l. 20	Bermuda
1901*a*.	♂	36	44	9	30	16	Bermuda
Young	♂	26	35	8	r. 19 l. 19	r. 9 l. 9	Bermuda
Young	♂	14	24	6	r. 12.5 l. 12.5	r. 6 l. 6	Bermuda
489 F. M.	♂	46	59	12.5	49	24	Davids I.

* Young, with carapace 7–9^{mm} long, were taken April 24, 1901.

Among the particular localities where we found it abundant were Castle Island, Charles or Goat Island, Bailey Bay Island, etc. It is mainly nocturnal in its habits. During the spring, while we were at Bermuda, it was very rarely seen out of its burrows in the daytime. Perhaps it partially hibernates in its burrows, at that season, like *C. guanhumi*, and becomes more active in summer.

In the early settlement of the islands it seems to have been much more abundant, at least in the cultivated lands, where it was said to be injurious. It was the subject of a law in early times, by which persons were forbidden to dig crabs on lands of other persons, thus causing damage to crops.* They were mentioned as then used for fish bait.

This species ranges from Bermuda and the Florida Keys through the West Indies to Venezuela and Ascension Island.

Cardisoma guanhumi (Latr.) *Great Land-Crab; "Juey."*

Cardisoma guanhumi Latreille, Encycl. Meth., Hist. Nat. Insectes, x, p. 685, 1825. M.-Edw., Illust. Edit. Cuvier, pl. xx, figs. 1—1*i*.

S. I. Smith, Trans. Conn. Acad. Sci., ii, pp. 36. 143. pl. v, fig. 3, 1870 (descr. and syn.) Miers, op. cit., p. 220, 1886.

M. J. Rathbun, Amer. Naturalist, xxxiv, p. 587, fig. 6, 1900.

Rankin, Crust. Berm. Is., p. 525, 1900. M. J. Rathbun, Brach. and Macr. Porto Rico, p. 15, 1901.

Verrill, these Trans., vol. xi, p. 17; The Bermuda Is., i, pp. 37, 264, 295, 1903. Young, op. cit., p. 246, 1900. Stimpson, Rep. Crust. N. Pacific Expl. Exped., p. 111, 1907.

Figure 3. Plate IX, Figure 1.

The color of adults in life is pale livid gray, on the carapace, becoming bluish gray on the margins and on the legs; ends of the chelipeds yellow. The young are brownish yellow or dusky brown, like the sand and mud. (A. H. Verrill.)

When well grown the male is about 18–20 inches across the extended legs; carapace about 4 to 5 inches broad. Claws very unequal in size, and variable in form, often widely gaping in the male. Some specimens are even larger. One from Dominica I. (coll. A. H. Verrill) was 21 inches in extent; 5 inches across the carapace; the larger claw (right) 6 inches long and about 3 broad. Right-handed specimens are more numerous in our collection than left-handed ones.

This large crab is found in a few localities in Bermuda, especially at Cooper's Island and around the shores of Hungry Bay. In the latter place its large and deep holes were observed by us 4 to 12 feet

* See The Bermuda Islands, i, p. 706 [294].

above high tide, and mostly among the matted roots of cedars, where they could not be dug out.

It is mainly nocturnal in its habits and can be taken at night, in summer, by the use of lanterns or torches. It was thus obtained by Moseley, at Hungry Bay (Voy. Challenger). Prof. W. R. Coe has given to the Yale Museum a large specimen taken in this same way in 1903. Mr. J. M. Jones sent a large Bermuda specimen to the Yale

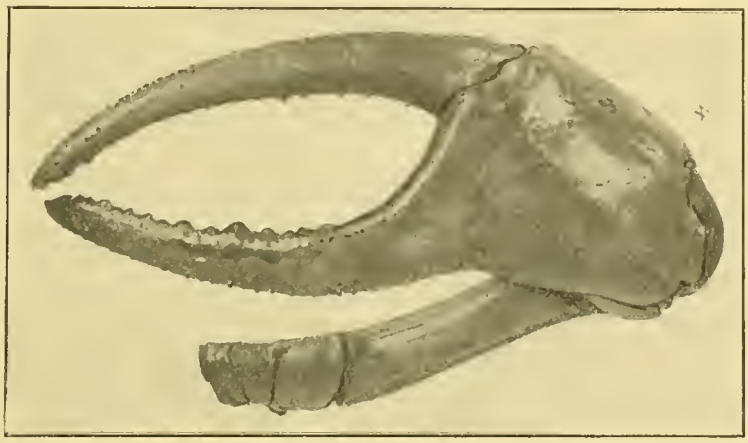

Figure 3.—*Cardisoma guanhumi*, large chela of male; ½ nat. size. Phot. A. H. Verrill.

Museum in 1877, without a statement of the exact locality. It is also in the collection made by Dr. C. Hartt Merriam (April, 1881, Yale Mus.), and in that of the Field Museum of Natural History, 1905.

Very little seems to be known in respect to its breeding habits and young stages.

*Measurements.**

Nat. Mus. number	Sex	Length of carapace	Breadth of carapace	Length of chelæ	Height of chelæ	Length of dactylus	Locality
7507†	♂	91	114	r. 75 l. 155	28 60	53 108	Jamaica
7669*a*‡	♂	64	76	r. 87 l. 45	40 19	58 31	"
7669*b*§	♀	63	75	r. 57 l. 47	26 19	37 30	"
7675§	♀	72	91	r. 79 l. 51	41 19	52 36	"

*The first ten series were made by Prof. S. I. Smith from specimens collected by the "Albatross" in 1884. The others are by the writer.

† Digits of chelæ slender and gaping.

‡ Digits stout. § Digits broad.

Nat. Mus. number	Sex	Length of carapace	Breadth of carapace	Length of chelæ	Height of chelæ	Length of dactylus	Locality
7533*a*‖	♀	71	84	r. 61 l. 59	28 26	41 40	Old Providence
7533*b*†	♂	72	86	r. 53 l. 110	22 48	35 79	" "
7532*	♀	74	93	r. 124 l. 98	53 23	87 39	" "
7535†	♂	68	85	r. 113 l. 55	48 22	75 37	" "
7534¶	♂	73	88	r. 98 l. 55	47 23	69 37	" "
7551§	♀	74	91	r. 78 l. 54	38 20	53 37	Curaçao
3146¶	♂	90	105	r. 75 l. 142	26 56	48 108	Bermuda
4061 Y. M.	♂	92	108	r. 72 l. —	r. 27 —	50 —	Bermuda
3147‖	♂	51	61	r. 65 l. 39	32 15		Bermuda
——	♂	—	125	r. 150			Dominica

† Digits of chelæ slender and gaping.

§ Digits broad.

‖ Digits broad and only slightly gaping.

¶ Digits not very slender, compressed, gaping.

Nos. 7533*a*, 7534, and 7551 had hairy legs. (S. I. Smith.)

According to Mr. A. H. Verrill, who found it very abundant in many localities in San Domingo, in 1907, especially at Samana and San Lorenzo, it constructs its burrows there almost everywhere in open grassy land or savannas, or even in yards and gardens, but only where there is clay soil beneath the surface. It brings up the soil in the form of hard pellets or ovoid balls, and deposits them around the mouth of the burrows. Some of the balls are often over an inch in diameter. The holes are sometimes 6 to 8 inches in diameter. They abound both on dry land and near the water, sometimes burrowing in the banks of streams. He did not find them particularly pugnacious and the natives handle them freely. They are slow and rather sluggish in their motions. About February they retire into their holes and close them up with small piles of earth made of pellets, remaining there for some time. During this time they are said to be fat and are esteemed as food, especially about Easter, by the natives. At that season they are sold in the markets. Later in the season, in summer and fall, they freely leave their burrows and run about, both at night and in sunlight. At such times they are "lean" and are not

considered fit to eat. They are very fond of meat and greedily devoured the bodies of birds that had been skinned. They are also fond of the cocoa-nuts and other fruits. The large rainfall at San Domingo may account for their living in comparatively dry localities there. Their hibernation is probably connected with their breeding season. When pursued it often takes to the water, if near the shore, but it is not a good swimmer. On Dominica Island he found it much less common. There it was more confined to low lands, near streams.

Saussure, who collected this crab in Cuba, Hayti, and Jamaica, states that it lives in large, deep holes near water, so that the lower part of the hole is filled with water, but where the surface is dry. It dies in a short time if kept entirely dry. He also states that it is very pugnacious and defends itself energetically when its retreat is cut off, seizing a stick so firmly that it can be lifted from the ground before letting go. He found its holes mostly in places shaded by bushes, etc.

It is used as food in most of the West Indian Islands, wherever abundant. Sold in Porto Rico markets under the name of "Juey." (Miss Rathbun.)

It has a wide distribution, being found on both coasts of tropical America, and on the West Coast of Africa. Common on most of the West Indian Islands. Range, Florida Keys to Brazil. Dominica Island (A. H. Verrill, Yale Mus.); San Domingo, abundant (A. H. V.); Cape de Verdes (Stimpson); Florida Keys (Smith); Brazil (White); Texas (Rathbun).

Family **GRAPSIDÆ** Milne-Edwards, 1837.

Carapace depressed or moderately convex, more or less quadrilateral, with the lateral margins straight or slightly arcuate. Front never very narrow, in general decidedly broad. Orbits and eye-stalks of moderate size. Third maxillipeds with the palpus articulated at the apex or at the front outer angle of the merus. Chelipeds in adult males usually subequal, moderately developed. In the walking legs the seventh joint is styliform, compressed, and either smooth or spiniferous. The pleon at the base usually covers the whole width of the sternum between the last pair of legs. (M. J. Rathbun.)

*Key to the Bermuda genera of the family Grapsidæ.**

A. Antennæ covered by the front.
  B. External maxillipeds without a piliferous ridge.
    C. Antennæ excluded from the orbit ..... *Goniopsis*
    C′. Antennæ entering the orbit.
      D. Carapace decidedly broader than long.
        E. Merus of maxillipeds longer than broad.
          F. Fingers spoon-shaped at tips ..... *Grapsus*
          F′. Fingers acute ..... *Geograpsus*
        E′. Merus of maxillipeds as broad as long ..... *Pachygrapsus*
      D′. Carapace about as long as broad, legs strongly fringed with hairs.. *Planes*
  B′. External maxillipeds with a piliferous ridge.
    C. Lateral margins straight. Carapace transverse, usually quadrate ..... *Sesarma*
    C′. Lateral margins arcuate and entire ..... *Cyclograpsus*
A′. Antennæ visible from above; two deep frontal notches.
  B. Merus of maxillipeds large, as broad as ischium ..... *Plagusia*
  B′. Merus of maxillipeds small, much narrower than ischium ..... *Percnon*

Goniopsis cruentatus (Latr.) DeHaan. *Mangrove Crab.*

Cancer ruricola DeGeer, Mémoires, Insectes, vii, p. 417, pl. xxv, 1778 (*non* Linné).

Grapsus cruentatus Latreille, Histoire Crust. et Insects, vi, p. 70, 1803. Desmarest, Consid., p. 132. M.-Edwards, Hist. nat. des Crust., ii. p. 85. Gibbes, op. cit., p. 181.

Goniopsis cruentatus DeHaan, F. Jap., p. 33, 1835; M.-Edw., Ann. Sciences nat. 3, xx, p. 164, pl. 7, fig. 2, 1853. Stimpson, Proc. Acad. Nat. Sci., Philad., 1858, p. 101. Smith, Crust. Brazil. these Trans., ii, p. 11, 1869 (syn., no descr.). Miers, Voy. Challenger, xvii, p. 267. (Bermuda.)

M. J. Rathbun, Brachyura and Macrura of Porto Rico, p. 15, pl. i, fig. 2 (colored), 1901. Verrill, The Bermuda Is., vol. i, p. 547, fig. 250, 1903. Rankin, Crust. Berm. I., p. 527.

Grapsus longipes Randall, Journal Acad. Nat. Sci., Philad., viii, p. 125, 1839.

Goniopsis ruricola White, List of Crust. in the British Museum, p. 40, 1847. Saussure, op. cit., p. 30, pl. 2, fig. 18, 1858.

Grapsus pelli Herklots, Addit. Faunam Carcin., Afr. Occid., 8, pl. 1, figs. 6, 7, 1851 (t. Kingsley).

Goniograpsus cruentatus Dana, Amer. Jour. Sci. (2), xii, p. 285, 1851; U. S. Expl. Exped., Crust., p. 342, pl. 21, fig. 7, 1852.

Goniograpsus cruentatus Kingsley, Synopsis Grapsidæ, Proc. Acad. Nat. Sci. Philad., 1880, p. 190 (syn. and descr.). Young, op. cit., p. 278, 1900.

Figure 4. Plate XI, Figure 1. Plate XII, Figure 4*a*.

In life a large female had the carapace very dark brown or black, with small, squarish, greenish markings, becoming more numerous

* This Key is taken from that of Miss M. J. Rathbun, Porto Rico Brachyura and Macrura, p. 15, with slight alterations.

posteriorly ; along the lateral margins and across the posterior border there is a series of small white blotches, about 2 to 3mm in diameter, the posterior ones smaller. The legs and chelipeds above are red, variegated with black and white spots, the black markings being most abundant on the posterior legs ; the anterior ones and the chelipeds being more red ; the first joint of the chelipeds is mostly red, with the black and white marks only at the edges ; the second and third joints on all the legs are red with black edges, without spots. The chelæ are mostly yellowish, becoming white at the tips and reddish at the joints ; the last joint of the other legs is yellow. All the legs are white beneath, except on the last three joints. Abdomen dark purplish brown below, whitish above anteriorly. Eye-stalks colored like carapace above, light red below.—C. S. V.

Figure 4.—Mangrove Crab, *Goniopsis cruentatus.* Carapace, about nat. size. Phot. A. H. V.

Most of the specimens are much brighter colored than the above, especially when the adherent dirt is removed. The larger males usually have a large amount of red on the back of the carapace and chelæ.

The variations in this species seem to be less than in many others of this family.

*Measurements.**

N. Mus. number	Sex	Length of carapace	Breadth of carapace	Breadth at anterior angles	Breadth of front	Locality
7542	♀	31.0	38.2	35.5	20.0	Old Providence
"	♀	34.7	42.5	39.0	22.0	" "
"	♀	44.5	55.0	48.0	28.0	" "

* The first ten series of measurements were made by Professor S. I. Smith from specimens collected by the "Albatross," in 1884. The others are by the writer.

N. Mus. number	Sex	Length of carapace	Breadth of carapace	Breadth at anterior angles	Breadth of front	Locality
7542	♂	34.0	39.5	37.0	20.4	Old Providence
"	♂	48.3	58.0	50.3	27.8	" "
"	♂	42.0	48.0	44.2	25.0	" "
"	♂	41.3	48.0	45.0	24.0	" "
7677	♂	41.6	48.2	45.8	24.6	Jamaica
7537	♀	35.8	43.3	40.3	23.3	Old Providence
"	♀	33.0	39.0	36.9	20.7	" "
3047 Y. M	♂	33	40	38	22	Bermuda
3047*a*	♂	27	31	30	17	"
1901*a*	♂	40	45	43	26	"
1901*b*	♀	26	29	29	16	"
1901*c*	♀	24	30	29	16	"
1901*d*	♂	18	23	23	13.5	"

The chelæ, which are nearly equal, measure in No. 3047 (see pl. xi, fig. 1) 27^{mm} long, 14.5 wide; in 3047*a*, they are 19^{mm} by 10^{mm}; in 1901*a*, 33^{mm} by 20^{mm}.

It has been taken at Bermuda by most collectors. It was in the collections of G. Brown Goode, A. Heilprin, Prof. T. Kincaid, Dr. T. H. Bean, Prof. E. L. Mark, Bermuda Biol. Sta., and others.

It was taken by us in several localities, especially at Coney Island, Hungry Bay, and at Somerset I., near the shore of "The Scaur." It is common among mangroves, living among the tangled roots in burrows, where it is not easily captured, owing to its shyness and agility. It sometimes actively climbs up the aërial roots and trunks of the mangroves, when disturbed.* We also sometimes found it in heaps of stones, at high-water mark, where it was more easily captured. Its colors, though showy, seem to be protective in many places where it lives, for they match the colors of the dead leaves and other objects in the swamps. Perhaps they are more particularly nocturnally protective, for it is most active at night.

It has a very extensive distribution, being found on nearly all tropical American shores. It ranges from Florida to Rio Janeiro, Brazil (Dana), and throughout the West Indies. West Coast of Africa at Ashantee (J. E. Benedict); Liberia; Guinea; Gabun; Angola, etc. West Coast of Central America (Kingsley). Florida Keys and Abrolhos Reefs, Brazil (Smith).

* In such cases it can easily be caught by shaking them off from the branches of the trees into hand-nets held below them.

Grapsus grapsus (Linn.). *Cliff Crab. Red Shore-Crab.*

Cancer grapsus Linné, Systema Naturæ, ed. xii, i, p. 1048, 1767; Amœnit. Acad., 2d ed., iv, p. 252, pl. 3, fig. 10, 1788.

Grapsus pictus Lamarck, Systéme Animaux sans Vertèb., p. 150, 1801.

Desmarest, Consider. Général. Crust., p. 130, pl. 16, fig. 1, 1825.

M.-Edwards, Hist. Nat. Crust., ii, p. 86, 1837 (Antilles); Régne animal de Cuvier, 3me édit., pl. 22, fig. 1.

Gibbes, Proc. Amer. Assoc. Adv. Sci., 3d meeting, p. 181 (17), 1850 (Florida).

Dana, U. S. Expl. Expd., Crust., p. 336, 1852 (Maderia, Cape Verdes, Peru, Paumotu Archipelago, Sandwich Is.). S. I. Smith, Trans. Conn. Acad. Sci., iv, p. 257, 1880 (synonymy and table of measurements).

Miers, Proc. Zool. Soc. London, 1877, p. 73 (Galapagos Is.; >(*G. altifrons* Stimp.).

Hilgendorf, Monatsb. Akad. Wissensch. Berlin, 1878, p. 807 (Mozambique).

Grapsus maculatus M.-Edwards, Ann. Sci. nat., III, xx, p. 167 (133), pl. 6 (= pl. 22, Règne animal de Cuvier, Crust.), 1853 (Antilles).*

Stimpson, Ann. Lyceum Nat. Hist. New York, vii, p. 229 (101), 1860 (Florida).

Kingsley, Proc. Acad. Nat. Sci. Philadelphia, 1879, p. 401 (Santa Cruz, Tahiti). Miers, Voy. Challenger, vol. xvii, p. 255, 1886. Young, op. cit., p. 280, 1900. J. E. Benedict, Crust. West Africa, Proc. U. S. Nat. Mus., xvi, p. 538, 1893.

Grapsus ornatus M.-Edwards, Ann. Sci. nat., III, xx, p. 168 (134), 1853 (Chili).

Grapsus Webbi M.-Edwards, Ann. Sci. nat., III, xx, p. 167 (133), 1853.

Stimpson, Proc. Acad. Nat. Sci. Philadelphia, 1858, p. 102 (48).

Grapsus altifrons Stimpson, Ann. Lyceum Nat. Hist. New York, vii, p. 230 (102), 1860 (Cape St. Lucas).

Grapsus grapsus M. J. Rathbun, Brachyura and Macr. Porto Rico, p. 16, 1901 (descr. and distr.). Rankin, Crust. Berm., p. 527, 1900. Verrill, The Bermuda Is., i, p. 94.

Plate X, Figure 6. Plate XI, Figure 2.

This is a large and conspicuous species, remarkable for its agility and swiftness. It runs and climbs over the rough and eroded rocks and cliffs between tides, and even to some distance above high-water mark, often ascending the nearly perpendicular cliffs with great agility. When pursued by man it usually escapes by rapid running, often hiding in some deep crevice or cavernous place. If hard pressed it will take to the water, where it can usually be caught with a landing net, for it cannot swim very rapidly. Sometimes several

* The name *C. maculatus* in the binomial system dates from Edwards' edition of Catesby, Nat. Hist. Carolinas, 1771, vol. ii, pl. xxxvi, where it is well figured in colors.

can be seen, at a distance, clustered together on the exposed cliffs, for their bright red chelæ and large size render them very conspicuous, but they usually run away rapidly or plunge into the water when approached.

It is not easy to explain how it could have acquired such bright colors by natural selection, for in Bermuda and most other regions where it abounds the colors appear not at all protective, unless at night, but quite the reverse. Possibly the colors were originally developed in some region where its surroundings were different, and red colors prevailed among the rocks ; but its colors may be nocturnally protective. At present the species has spread all around the world in tropical seas, and it does not much need color protection, owing to its watchfulness and agility, yet it is often killed by sea-fowl, and also by the *Octopus*.

The colors are somewhat variable. Some are much redder than others. A large one, in life, had the carapace very dark brown, thickly and irregularly mottled and spotted with bluish and grayish white ; the lighter color predominating in the radial grooves. Chelipeds with the chelæ and carpal joints bright dark red, white at tips of claws ; basal joint pale blue, red at the ends. Legs dark reddish brown above, thickly blotched with bluish white, and bright red at each joint. The posterior pair of legs are tinged with orange on the lighter parts. Beneath, orange red and light blue ; branchial areas, oral organs, and area in front of mouth mostly light blue ; sternum and under side of legs, orange and blue.

The sexes differ very little in size or color. The larger males are often brighter red than the females, but not constantly so. The ground-color is often blood-red with most of the small yellow spots round and about 1 to 2^{mm} in diameter. The chelæ of the males are usually a little larger than those of the females. The right and left differ but little in the male. Some females taken by us in April, 1901, carried eggs.

This species also varies considerably in its form and the proportions of length to breadth of the carapace, as shown by the following table of measurements. The front is often nearly or quite perpendicular, but in other cases more or less oblique.

*Measurements.**

N. Mus. number	Sex	Length of carapace	Breadth of carapace	Breadth across ant. angles	Br. of front	Height of front	Localities
7647*a*†	♀	44.0	48.3	35.3	18.5	8.0	St. Thomas
7647*b*†	♀	37.5	40.5	30.4	15.0	7.2	" " Yale
7647*c*†	♀	38.0	42.3	31.7	15.8	7.5	" "
7647*d*‡	♀	27.5	30.4	23.8	11.7	4.6	" "
7647*e*§	♀	20.0	22.9	18.4	8.5	3.5	" "
7647*f*‖	♂	33.5	37.7	28.6	14 0	6.0	" "
7647*g*†	♂	37.7	41.6	30.3	15.2	6.5	" " Yale
7647*h**	♂	50.0	53.0	38.2	20.0	9.0	" "
7647*i**	♂	54.3	60.0	41.5	21.5	10.0	" "
7543*a*‡	♂	37.0	42.0	30.2	15.0	6.4	Old Providence
7543*b*‡	♀	37.6	42.0	30.4	15.2	6.5	" "
7564*a*†	♂	38.6	43.2	31.5	15.5	6.9	Sabonilla
7564*b*‖	♂	35.1	38.0	29.0	14.4	6.1	"
7564*c*¶	♀	24.0	27.0	21.2	9.8	3.8	"
7564*d*¶	♀	24.2	27.1	21.6	10.0	4.0	" Yale
7564*e*¶	♂	27.0	30.0	23.1	11.0	4.3	"
7564*f*¶	♂	21.0	23.5	19.0	8.9	3.5	"
7840¶	♀	25.0	21.8	21.8	10.1	4.2	Curaçao
Yale Mus.	♂	37.2	40.5	29.5	14.7	—	Bermuda
4064 Y. M.	♂	67.0	73.8	47.7	26.8	—	Bermuda
4066 YM **	♂	60.0	72.5	46.0	26.0	—	La Paz., L. Cal.
4062 Y. M.	♂	65.0	73.0	58	30.0	12	Bermuda
1901 Y.M.*a*	♂	50	58	42	21	—	"
1901*b*	♀	54	61	42	22	—	"
1901*c*	♀	58	62	34	27	—	"
1901*d*	♀	51	57	40	23	—	"
1898*a*	♂	66	72	49	30	—	"
1898*b*	♀	55	60	41	24	—	"

Chelæ.

		Right		Left	
		length	height	length	height
1901*a*	♂	30	18	26	15
1901*b*	♀	24	14	24	14
1901*c*	♀	25	17	23	13
1898*a*	♂	45	27	44	20

*The first 19 series are by S. I. Smith from specimens collected by "the Albatross" in 1884, mostly now in the U. S. Nat. Museum.

† The front is perpendicular. ‡ The front is slightly oblique.

§ The front is considerably oblique. ‖ The front is very slightly oblique.

¶ The front is nearly perpendicular. ** The front is decidedly oblique.

In nearly all the Bermuda specimens measured the front is nearly perpendicular and very concave.

Nos. 7564*d*, coll. Jan. 17–24, and 7840, coll. Feb. 10–18, carried eggs.

** The right chela in this was 43^{mm} long, 27^{mm} broad; the left was 44^{mm} long, 27^{mm} broad.

It has been taken at Bermuda by nearly all collectors.

We found it very common on most of the precipitous and rocky shores of Bermuda in 1898, but it was far less common in March and April, 1901. Probably the cold period earlier in the winter and spring of 1901, which was so fatal to the fishes,* also killed off many of the crabs of this and allied species.

This species is found on all tropical coasts. On the Atlantic coast it extends from Florida to Brazil. On the Pacific side it ranges from Peru to Lower California. West Africa, at many localities. Cape Verde Islands (Dana, Stimpson). Ascension I. and Fayal (Benedict). Young individuals were taken by us on the reefs and serpentine atolls at Bermuda. Miss Rathbun has recorded an instance of a young one taken on the Pacific far from land. Small specimens often occur among barnacles, etc., on the bottoms of vessels.

Pernambuco, Brazil, New Zealand, Tahiti, Natal, Mauritius (Kingsley). Hawaiian Is. (Dana).

Four specimens were taken from the bottom of a vessel recently arrived from Swan Island, W. Indies, at Woods Hole, Mass., July 14, 1887, (t. S. I. Smith in MSS.).

Geograpsus lividus (Edw.) Stimp.

Grapsus lividus A. Milne-Edw., Hist. Nat. des Crust., ii, p. 85, 1837; Melang. Carcinol., p. 135.

Geograpsus lividus Stimpson, Proc. Acad. Nat. Sci., Philad., 1858, p. 101; Notes on North Amer. Crust., Annals Lyc. Nat. Hist., N. York, vii, p. 230; 1860. Kingsley, Proc. Acad. Nat. Sci., Philad., p. 195, 1880 (description). M. J. Rathbun, Proc. U. S. Nat. Mus., xxi, p. 604, 1898; Brach. and Macr. Porto Rico, p. 16, 1901; Verrill, these Trans., xi, p. 574, 1900.

Geograpsus occidentalis Stimpson, Annals Lyc. Nat. Hist. N. Y., vii, p. 230, 1860 (West Coast).

FIGURE 5. PLATE XXVI, FIGURE 1.

In life, the carapace in our specimens was light yellowish brown, marbled or irregularly reticulated with very dark brown streaks, or umber-colored markings, most numerous anteriorly; legs olive-brown above, paler beneath; abdomen pale bluish gray. (C. S. V.)

*See The Bermuda Islands, i, p. 91; these Trans., vol. xi, p. 503.

Nat. Mus. number	Sex	Length carapace	Breadth carapace	Br. at ant. angles	Br. of front	Locality
7344*a*	♂	20.0	24.0	20.6	10.4	Sabonilla
7344*b*	♂	17.0	20.9	17.6	8.8	"
7344*c*	♀	11.9	15.0	13.0	6.4	"
7344*d*	♀	15.0	19.0	16.1	8.0	"
7344*e*	♀	17.5	21.6	18.4	9.0	"
7344*f*	♀	19.0	23.5	20.0	10.0	"
7344*g*	♀	19.9	24.5	20.3	10.1	"
7344*h*	♀	22	27.0	22.0	11.0	"
7344*i*	♂	22.5	28.0	22.4	11.3	"
36	♀	18.3	23.8	19.2	10.0	Bermuda (Goode)

Nos. 7344*a*—*i* were measured by Prof. S. I. Smith.

Nos. 7344*e* and *f* were carrying eggs. Taken by the "Albatross," March, 1884.

A single Bermuda specimen (No. 36) was in the collection of G. Brown Goode. The Yale party took two adult specimens in 1898. A larger broken ♂ specimen is in the collection of the Bermuda Biol. Station, 1903, taken at Hungry Bay. Breadth between outside of orbits, 23^{mm}; length of chela, 21; height, 10.5^{mm}. It occurs under stones on rocky shores and sometimes on coral reefs.

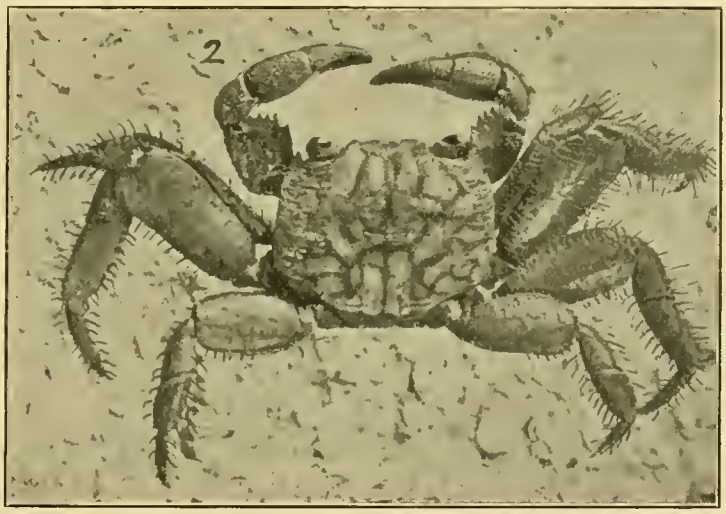

Figure 5.—*Geograpsus lividus*, from Bermuda, × about 1¼. Phot. A. H. V.

Its known range is extensive; from Florida to the Antilles and Columbia. On the West Coast, from Cape St. Lucas to Chili (*G. occidentalis* Stimp.). James I., Galapagos (M. J. Rathbun).

Pachygrapsus transversus Stimpson. *Mottled Shore-Crab.*

Grapsus transversus Gibbes, Proc. Amer. Assoc. Adv. Sci., 3d meeting, p. 181 (17), 1850 (Florida).

Pachygrapsus transversus Stimpson, Ann. Lyc. Nat. Hist. New York, vii, p. 64 (18), 1859; Amer. Jour. Sci. (2), xxvii, p. 446, 1859.

Smith, Report Peabody Acad. Sci. Salem, 1869, p. 91, 1871 (Pacific coast Central America); Trans. Conn. Acad., iv, 259, 1880 (synon. and measurements).

M. J. Rathbun, Branner–Agassiz Exp. Brazil, p. 137: Brach. and Macr. of Porto Rico, p. 17, 1901 (descr.).

Kingsley, Proc. Boston Soc. Nat. Hist., xx, p. 158, 1879 (descr.); Proc. Acad. Nat. Sci. Philadelphia, 1879, p. 400; op. cit., p. 199, 1880 (syn. and descr.).

Goniograpsus innotatus Dana, Proc. Acad. Nat. Sci. Philadelphia, 1851, p. 249 (3), 1851 (South America); Crust. U. S. Expl. Exped., p. 345, pl. 21, fig. 9, 1852.

Metopograpsus miniatus Saussure, Crust. Mexique et Antilles (Mém. Soc. Phys. Hist. nat. Genève, xiv), p. 28, pl. 2, fig. 17, 1858. (Parasited, t. Rathbun.)

Metopograpsus dubius Saussure, op. cit., p. 29, pl. 2, fig. 16, 1858.

Pachygrapsus intermedius Heller, Zool. Bot. Verein Verhandl., Wien, xii, 1862, p. 521 (Brazil); Reise der Novara, Crust., p. 44, 1865. Smith, Trans, Conn. Acad., ii, p. 37.

Pachygrapsus socius Stimpson, Ann. Lyc. Nat. Hist. New York, x, p. 114 1871 (Cape St. Lucas, Panama, Peru).

Plate XII, Figures 3—3*b*.

This species is very variable in colors, but the tints are evidently decidedly protective. The mottlings of yellow, olive, and brown closely resemble the colors of the stained and weather-beaten rocks and dead algæ among which it usually lives.

In life, the ground-color of the carapace is most frequently dull olive-green, yellowish, or yellowish-brown, sometimes dull gray, more or less covered by irregular mottlings of darker brown, reddish, or dark olive, usually darkest anteriorly, where the transverse ridges are often edged with reddish or dark brown, making them more conspicuous; large chelæ are often plain light brown or reddish brown, usually with pale tips, but in some cases they are blotched with darker brown, or tinged with bright red on some parts, especially at the joints. The pereiopods are usually banded with darker and lighter brown.

*Measurements.**

Sex	Length	Breadth	Front	Locality
♀	10.1mm	13.2	7.2	Provincetown
"	11.0	15.0	8.3	Florida
"	11.4	15·9	8.8	"
"	11.5	15.6	8.6	Brazil
"	13.7	18.2	9.8	Acajutla
"	14.2	19.0	10.8	Bermuda
♂	10.0	12.8	7.0	Paita, Peru

* Many of the measurements are by Prof. S. I. Smith.

Sex	Length	Breadth	Front	Locality
♂	10.5	13.7	7.6	Bermuda
"	10.5	13.9	7.6	Panama
"	10.7	14.1	7.8	Bermuda
"	10.7	14.2	7.7	Panama
"	11.0	14.3	7.6	Brazil
"	12.4	16.4	9.0	Bermuda
"	12.5	16.3	8.9	Florida
"	13.1	17.2	9.6	Bermuda
"	13.8	17.4	9.8	Panama
"	14.5	18.2	10.0	Brazil
"	15.2	19.4	10.6	Panama
"	15.3	19.7	10.6	Brazil
"	9.2	13.0	7.0	Bermuda
"	13.0	17.0	10.0	Bermuda†
♀	15.5	21.0	15.0	Bermuda‡

† Length of largest chela, 13^{mm}; height, 6^{mm}.

‡ Length of largest chela, 11.5^{mm}; height, 5.5^{mm}.

The proportion of length to breadth of the carapace varies from 1:1.25 to 1:1.41, but is usually about 1:1.30 to 1:1.35.

A parasitic isopod crustacean sometimes infests its branchial cavities and in some cases causes an enlargement or distortion, due to the swelling of the carapace on one side. The parasite, which is allied to Bopyrus and Cepon, is relatively large.* It occurred in about 25 per cent. of the adult specimens examined from some localities. Some of the specimens collected in April carried eggs. Some were then soft-shelled. Specimens collected in June and July (Berm. Biol. Sta.) also carried eggs.

This appears to be the most abundant shore crab at Bermuda. It is to be found everywhere between tides where there are loose stones or masses of dead algæ under which it can conceal itself. It is also to be seen running actively about in such localities, where it is often associated with *Sesarma Ricordi* and *Planes minutus*.

It is sometimes found, also, on the coral reefs. Also among the roots of mangroves.

It has been taken in Bermuda by nearly every collector of Crustacea.

It has a very wide distribution in all tropical and subtropical seas. It has been found among the barnacles, etc., scraped from the bot-

* These parasites have recently been sent to Miss Harriet Richardson, who identifies them as *Leidya distorta* (*Cepon distorta* Leidy). It was originally found in the gill-cavity of a "fiddler-crab" (*Gelasimus pugilator*) by Leidy on the coast of New Jersey. It has seldom been found by later collectors.

toms of vessels far from its usual habitats. In this way its range may have been greatly extended by commerce in modern times. Adult living specimens were taken at Provincetown, Mass., in 1879. They occurred among barnacles, etc., on the bottom of a whaling vessel returned from a cruise in the Gulf Stream region and were associated with other southern species. (See S. I. Smith, 1884.)

It ranges from Florida and Bermuda to southern Brazil; from Peru to the Gulf of California; West Africa at Loanda, etc. Cape Verde Islands and Madeira; East Indies; Australia; New Zealand; Tahiti; Galapagos Is.; Pernambuco, etc.; Brazil, on stone reefs, and Maceio on coral reefs (M. J. Rathbun); Rio (Heller); Australia (Miers).

Pachygrapsus gracilis (Saussure) Stimp.

Metopograpsus gracilis Saussure, Mem. Soc. Phys. Hist. Nat. Geneva, xiv, p. 443, pl. II, f. 15, 15*a*, 1858.

Pachygrapsus gracilis Stimpson, Ann. Lyc. Nat. Hist. N. York, x, p. 113, 1871. Kingsley, Proc. Boston Soc. Nat. Hist., xx, p. 159, 1870 (descr.). Synop. Grapsidæ, Proc. Acad. Nat. Sci., Philad. for 1880, p. 200 (syn. and descr.) M. J. Rathbun, Branner–Agassiz Exp., p. 137, 1900; Brach. and Macr. of Porto Rico, p. 17, 1901.

FIGURES 6, 6*a*. PLATE XII, FIGURE 2.

This is usually smaller than the preceding, and is much less common. Its colors are similar, but the reticulations and mottlings are darker brown. It can best be distinguished by the more prominent, thin, and nearly straight, front; the straighter sides of the carapace,

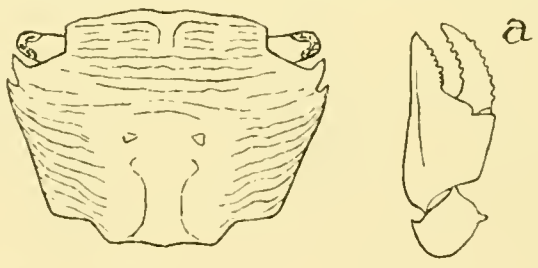

Figure 6.—*Pachygrapsus gracilis*, carapace enlarged; 6*a*, one of the chelæ. After Saussure.

which is not plicated over the cardiac region; and by the chelæ, which have small denticles on the upper side of the carinate manus, and on the dactylus. The manus has fine oblique ridges above, and the carpus is covered with fine oblique and irregular ridges.

It appears to be rare at Bermuda, or at least is seldom taken there. A few good specimens were found at Bermuda by us in 1898 and April, 1901; one of the latter carried eggs. A specimen was also obtained by Mr. Goode, 1876. It has been found at the Florida

Keys, Yucatan, and in the West Indies. Brazil, on mangroves (Rathbun.) It is most frequently found among the roots of mangroves.

Measurements.

No.	Sex	Carapace length	Carapace breadth	Between orbits	Chelæ length	Chelæ height	Locality
4018*a*	♀	11	14	10	9	4	Bermuda
4018*b*	♀ eggs	10.5	13	9	7.5	3.5	"
4018*c*	♀	15.5	20.5	14	11	5.2	"
4018*d*	♀	13	16.5	10	8.5	4	"

Planes minutus (Linn.) Dana. *Gulf-weed Crab.*

Cancer minutus Linné, Syst. Naturæ, ed. 12, i, p. 1040, 1767. Fabricius, Syst. Ent., p. 402, 1775.

Grapsus minutus Latreille, Hist. nat. Crust. et Insectes, vi, p. 68, 1803.

Grapsus cinereus Say, Jour. Acad. Nat. Sci. Philad., i, p. 99, 1817 (*nonGrapsus cinereus* Bosc, *nec Grapsus* (*Sesarma*) *cinereus* Say, 1818).

Grapsus pelagicus Say, op. cit., p. 442, 1818.

Nautilograpsus minutus H. Milne-Edwards, Hist. nat. Crust., ii, p. 99, 1837. Smith and Harger, these Trans., iii, p. 26, 1874. Smith, op. cit., iv, p. 263 ; v, p. 120. Stimpson, Crust. N. Pacific Expl. Exped., p. 121, 1907.

Planes Linnæana Bell, British Stalk-eyed Crust., p. 135 (cut), 1844. White, List of Crust. British Mus., p. 41, 1847.

Planes minutus Dana, United States Expl. Exped., Crust., p. 346, 1852. Kingsley, Synopsis Grapsidæ, Proc. Acad. Nat. Sci. Philad., for 1880, p. 202 (descr. and syn.).

Figure 7. Plate XIII, Figures *a—j'*. Plate XXVII, Figure 6.

In life, this small crab varies greatly in form and color. Usually it is irregularly mottled or blotched with light greenish yellow or pale yellow on a darker olive-green ground-color, usually with a large blotch or spot of pale yellow or whitish on the back of the carapace, thus imitating the olive-green colors of the gulf-weed (*Sargassum*) and the whitish patches of Bryozoa (*Biflustra*) with which the *Sargassum* is commonly covered. Thus its colors are eminently protective, for it naturally lives in the open sea among *Sargassum*.

Measurements of Bermuda specimens.

Sex	Carapace length	Carapace breadth	Front breadth	Chela, larger, length	Chela, larger, height
♂	16	17	9	16	8
♀	13	13	8	9	5
♂	15	15	8	12	6.5
♂	15	15	8	13	7.5
♀	19.5	20	10.5	14	7.5
♂	18	19	10	16	10

The last two are from the region of the Gulf Stream.

Some of the specimens taken in April, 1901, were carrying eggs. Several of those collected by the Bermuda Biological Station in June and July, 1903, also carried eggs.

Wherever fresh masses of *Sargassum* are cast up by the waves this crab can almost always be found beneath them, often in considerable numbers. It is usually associated with small specimens of *Portunus Sayi* and two species of shrimp (*Latreutes ensiferus* and *Leander tenuicornis*). It is contained in all the Bermuda collections that I have examined.

The 36 specimens illustrated on my plate V, to show their variations in form and color, were all taken, with many more, under a single mass of *Sargassum* in March, 1901, by A. H. Verrill.

It is a good swimmer, however, having long legs bordered by a dense fringe of hairs, so that it is not entirely dependent on the *Sargassum*.

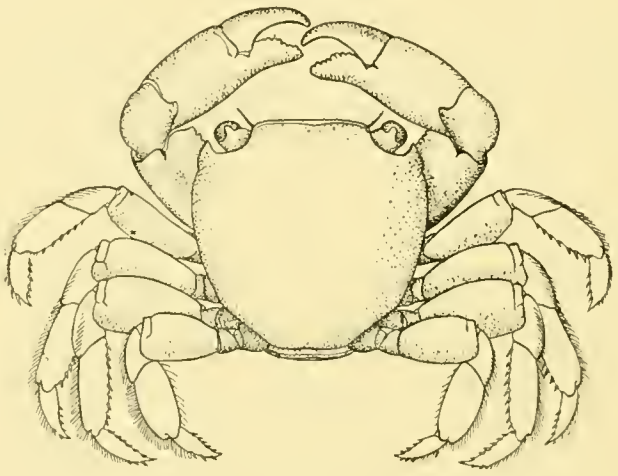

Figure 7.—Gulf-weed crab, *Planes minutus*, enlarged 1½. The hairs of the legs are mostly omitted. J. H. Emerton del.

It is widely distributed, occurring in all tropical and subtropical seas in floating *Sargassum*.

In the Atlantic it occurs along the course of the Gulf Stream as far north, at least, as George's Bank and off Nova Scotia. It is sometimes cast ashore on the coasts of New England and Great Britain. Prof. Smith has recorded a large specimen found at Woods Hole, Mass., by V. N. Edwards, Sept. 11, 1877. Southward it extends to Brazil and Falkland Is. (Kingsley); on the Pacific coast from Peru to the Gulf of California. Also found in the central Pacific and Indian Oceans; Mediterranean (Heller). West Coast of Africa, Cape St. Lucas (Stimpson); Indian Ocean (M.-Edw.); New Zealand and Natal (Kingsley).

Sesarma Ricordi M.-Edw.

Sesarma Ricordi H. M.-Edw., Ann. Sci. Nat., ser. 3, vol. xx, p. 183, 1853. Kingsley, Proc. Acad. Nat. Sci., Philad., for 1880, p. 217. M. J. Rathbun, Synopsis Sesarmæ, Proc. Biolog. Soc. Washington, xi, p. 91, 1897 (descr. and synon.).

Brachy. and Macr. Porto Rico, p. 18, 1901 (descr.). Verrill, these Trans., x, p. 574, 1899.

Sesarma angustipes Stimpson (*pars*) Smith, these Trans., ii, p. 159, 1869 (*non* Dana, t. M. J. Rathbun).

Sesarma cinerea Stone, in Heilprin, op. cit., 1898. Rankin, op. cit., p. 526, 1900 (*non* Say, sp.).

Sesarma Stimpsonii Miers, 1881, not of 1886 (t. Rathbun).

Plate X, Figure 2. Plate XI, Figure 3, var.

This common species is very variable in colors in life. The carapace is usually irregularly and variously mottled with olive-brown, olive-green, or reddish brown on a yellowish green or light olive ground color, in most cases pretty closely imitating the varied colors of the dead algæ and stained stones among which it most commonly lives.

Miss Rathbun, who has examined many of the original types, unites several nominal species with this. It seems to be distinct from the true *cinerea* and *angustipes*, with both of which it has often been confused. Probably the real *cinerea* does not occur at Bermuda.*

The carapace of the typical variety appears nearly smooth to the eye over most of the surface, but under a lens shows minute sparse granules and hairs, which become more evident anteriorly and on the front, while on the sides, posteriorly, there are faint oblique plicæ. The lateral margins are nearly straight or only slightly sinuous; the front is a little sinuous on the edge with a slight median notch. The carapace is only slightly broader than long.

Measurements of Bermuda specimens.

Number	Sex	Carapace length	Carapace breadth	Front breadth	Chelæ length	Chelæ height
a	♀	17	18	10	7	4
b	♂	16	17	9	12	7.5
c	♂	14	15	8	10	6
d	♂	13	13.5	7	9	5.5
e	♂	14.5	15	7.5	10	6

* Dr. Rankin has kindly sent me for examination the specimens that he recorded (1900) as *S. cinerea*. They prove to be *S. Ricordi*.

This is one of the most common species, taken by nearly all collectors in Bermuda. It is often seen running actively about among the stones and dead seaweeds, from low tide nearly to high-water mark, usually associated with *Pachygrapsus transversus*. It may almost always be found under masses of *Sargassum* cast up on the shores as well as under stones.

Its range extends from Florida through the West Indies to Trinidad.

Sesarma Ricordi, var. **terrestris,** subspecies or var. nov.

Plate XI, Figure 3.

This form first attracted my attention on account of its peculiar habits. Unlike most *Sesarmæ*, it lives away from the water, often in very dry, barren, sandy fields or pastures, under stones, though it was also found not far from the shore but where the soil was dry. It runs very rapidly when disturbed, and hides in holes or under other stones, but does not seek the water. Its color was darker than in the ordinary form, and the carapace was usually more or less covered by short hairs and adherent dirt, obscuring the colors, and giving it a gray appearance. Although so different in appearance and habits, it agrees so closely in form and structure that it seems to be only a variety that has acquired terrestrial habits, with trivial changes adapting it better for this mode of life.* But no really intermediate specimens were found. Thus it seems to be a form or subspecies of some considerable antiquity and constancy.

The carapace appears more rough and uneven than in the ordinary form, for it is more strongly areolated and the branchial areas are more swollen, so that the vertical thickness is greater and the reticulated areas of the sides are broader, giving a larger surface for aëration of the water, and indicating larger gill cavities and gills. The dorsal surface of the carapace is covered with more numerous and larger granules, bearing numerous short dark hairs, very evident under a lens of low power, and capable of holding adherent dirt: the plicæ on the postero-lateral sides are stronger and more granulous; the lateral marginal edge is more sinuous anteriorly, owing to the more swollen branchial chamber. The anterior frontal margin is less sinuous, the median indentation often being obsolete or faint.

* The specimens have also been studied by Miss M. J. Rathbun, who agrees with me in its relations.

The ambulatory legs are distinctly larger and longer than in the common form. When the legs are folded the tooth on the distal angle of the merus joint of the legs of the 3d and 4th pairs reaches considerably (2–3^{mm}) beyond the outer orbital angle, while in *Ricordi* it just reaches it, or only slightly exceeds it (.5^{mm} or less). The proportion of the merus joints of these legs to the breadth of the carapace is 1 : 1.36. In *Ricordi*, 1 : 1.5. Ratio of same to length of carapace, 1 : 1.2. In *Ricordi*, 1 : 1.4.

The colors, when living, appear dull or sordid yellowish brown, or mud-color, due to adherent dirt, often mottled with reddish brown. Fresh specimens cleaned in alcohol were variegated with pale bluish gray, dark brownish gray, and blackish, with some yellowish white ; an irregular pale band, speckled with dark gray, extends from eye to eye. Legs above variegated with similar colors, but paler, the dark brown color mostly in irregular transverse bands. Chelæ whitish or pale yellow ; legs bluish white beneath. Some specimens have the carapace finely specked with red.

Measurements of Bermuda specimens.

Number	Sex	Carapace length	Carapace breadth	Front breadth	Chelæ length	Chelæ breadth
3148*a*	♂	18.0	20.0	11.0	15	8.5
3148*b*	♂	16.0	17.0	9.0	12	7.0
3148*c*	♀	17.5	18.5	9.7	10	5.5
d	♀	17.0	19.0	11.0	10	5.5
e	♂	13.5	15.5	8.0	10	7.0

This subspecies is, perhaps, in process of gradual differentation, and destined to eventually become a valid species with true terrestrial habits should it not be prematurely exterminated. At present it has few enemies. It lives in waste uninhabited places. It is not uncommon in several localities. We found it not far from Hungry Bay; on the low barren hills of some of the smaller islands in places partly covered with sparse grass ; and in other localities.

Several good specimens in the Yale Museum were collected by J. M. Jones, before 1867. They have no special labels as to seasons or stations.

This variety approaches *S. cinerea* Say in some characters more nearly than does the common form. In respect to the granulation of the front and frontal lobes, the specimens of *S. cinerea* in the Yale Museum, from Indian River and St. Augustine, Fla., labelled as *S. cinerea* by Miss Rathbun, and which I have compared with this

form, are even less granulated.* Indeed, the latter are scarcely more granulated than the ordinary form of *Ricordi*.

However, the front of *S. cinerea* is narrower and more arched than in *S. Ricordi*; its lower margin is less sinuous, narrows more toward the ends, and is less turned up at the edge, so that it is less concave above. The orbital notch is not so deep. Still these differences are but slight. The carapace seems to be slightly less convex. The chelæ are essentially the same in both, and the carpal joint is roughened in the same way. The merus joints of the pereiopods are about equally flattened in both; the brush of hairs on the under

Figure 8.—*Sesarma cinerea* (from Florida), slightly enlarged. Phot. A. H. V.

side of the last two joints is nearly the same in both, though perhaps a little smaller, and with shorter hairs in *S. cinerea*. The differences are so slight that it seems not improbable that *S. cinerea* is another semiterrestrial race or subspecies that has been derived from *S. Ricordi*, under a somewhat different environment. In fact, all those species that live more or less on the dry land or in trees (e. g., *S. Roberti*, an arboreal West Indian species) must have been originally derived from amphibious or aquatic species, but the differentiation has gone farther in some than in others. Doubtless they all go into the sea to breed, and probably they all have similar zoëa and megalops larval stages.

But in the case of the Bermuda forms, it is easy to believe that they have acquired different breeding habits or different breeding

* In Miss Rathbun's analytical table of *Sesarmæ* (Synopsis American Sesarmæ, Proc. Biolog. Soc. Washington, xi, pp. 90, 91, 1897), the smoothness of the suprafrontal lobes, "smooth or nearly so," is made a diagnostic character for *S. Ricordi*, while *S. cinerea* is put in a group having the suprafrontal lobes "tuberculate or granulate," and in a subgroup having them "faintly granulate." The degree of granulation seems to be variable.

seasons, so that they may no longer interbreed. It is also probable that the young crabs of var. *terrestris*, when they quit the megalops stage at the shore, have inherited the instinct to seek the uplands. A careful study of these species in summer might settle these points.

Sesarma Miersii Rathbun.

Sesarma (Holometopus) Miersii M. J. Rathbun, Synopsis American Sesarmæ, Proc. Biolog. Soc. Wash., xi, p. 91, 1897 (descr. and synon.); Branner-Agassiz Exp. to Brazil, p. 138, 1900. Verrill, these Trans., vol. x, p. 574, 1900.

Sesarma Stimpsoni Miers, Rep. Voy. Challenger, Zool., xvii, p. 270, 1886 (not of 1881).

Plate XII, Figure 5.

This species can be distinguished from the preceding by the tuberculated or distinctly granulated protogastric region of the carapace, which in the latter is nearly smooth.

Ordinary mature specimens have the carapace about 19^{mm} long and 21^{mm} wide.

Miss Rathbun refers a young specimen, collected by us in 1898, to this species. It appears to be very rare in Bermuda.

It ranges from Bermudas and the Bahamas to Rio Janeiro, Brazil. Rio Parahyba do Norte (Rathbun). It lives mostly among the roots of mangroves.

Cyclograpsus integer Edw.

Cyclograpsus integer Milne-Edw., Hist. Nat. des Crust., ii, p. 79, 1837. Kingsley, Proc. Acad. Nat. Sci., Philad., Carcinol. Notes, iv, p. 221, 1880. Rankin, Crust. Bermuda, p. 526, 1900. M. J. Rathbun, Brach. and Macr. of Porto Rico, p. 18, 1901.

Plate XII, Figure 1.

This species is easily recognized by its smooth carapace, with convex sides. It is very rare in Bermuda.

It was not found by us, nor has it been taken by any recent collector. A single specimen in the collection of Mr. Goode was identified as this species by Prof. S. I. Smith. The same one was recorded by Rankin. The only other record is that of Heilprin, also a single specimen. It sometimes occurs on coral reefs.

It ranges from Florida to Brazil, and throughout the West Indies. Florida (Kingsley); Porto Rico (Rathbun); Brazil (M.-Edw.).

Plagusia depressa (Fabr.) Say.

Cancer depressus Fabr., Ent. Syst., Supl., p. 406, 1775.

Plagusia Sayi DeKay, N. York Fauna, p. 16. Stimpson, Notes on N. Amer. Crust., i, p. 18 [64]; ii, p. 104 [232].

Plagusia depressa Say. Journ. Acad. Nat. Sci. Philad., i, p. 100, 1817. Rathbun, Dec. Crust. W. Africa, p. 281 (distribution). Results of Branner-Agassiz Exped. to Brazil, Biolog. Soc. Wash., ii, p. 138, 1900; Brach. and Macr. Porto Rico, p. 19, 1901. Verrill, these Trans., vol. x, p. 575, 1900. Benedict, Notice Crust. W. Africa, p. 538, 1893.

Plagusia squamosa Dana (*non* Edw.). Stimpson, Crust. N. Pacific Expl. Exp., Smithsonian Misc. Coll., xliv, p. 122, 1907.

Figure 9. Plate X. Figure 1.

When full grown this is a large and handsomely colored crab, remarkable for its shyness and agility. Its colors, which are variable, are evidently protective, and by no means conspicuous when resting

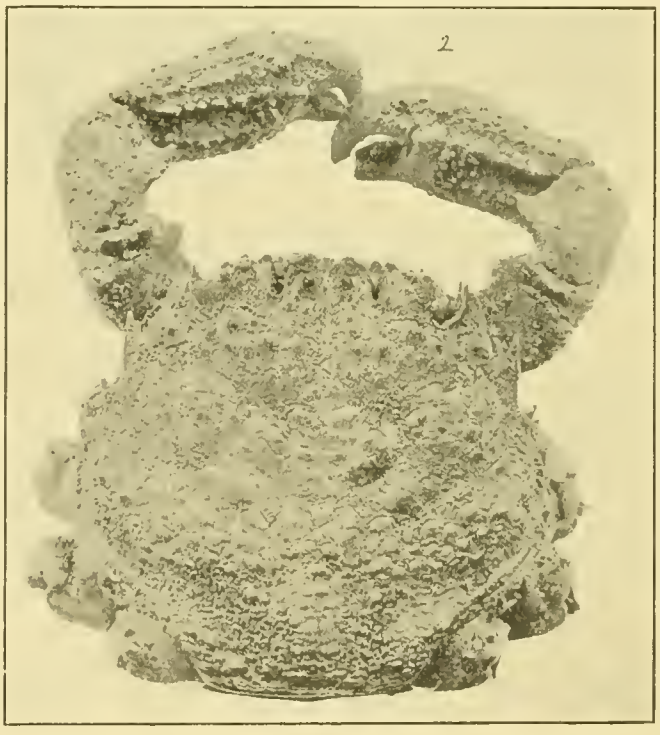

Figure 9.—*Plagusia depressa*, carapace and chelæ of adult male, about nat. size. Phot. A. H. Verrill.

among the rough and stained shore ledges where it usually lives. It is much less conspicuous than *Grapsus grapsus*, which lives in similar situations.

Some large specimens had a grayish or yellowish ground color, mottled and spotted with brown and red; the spots are often bright.

Measurements of Bermuda specimens.

No.	Sex	Carapace length	Carapace breadth	Front width	Chelæ length	Chelæ height
31	♂	51	49.5	34	28	13
3153	♀	45	48	21	r. 18	6
879 F. M.	♂	47	50	17	l. 22	11

Sometimes it may be seen running with great rapidity over the rough ledges and cliffs, often above high-tide mark, in the same manner as *Grapsus grapsus*, but it is even more alert, and swifter in its motions, so that its capture is difficult. It readily takes to water when pursued and swims very well.

Although not rare, it has occurred in but few Bermuda collections, and usually singly, owing probably to the difficulty of capturing it.

In 1898, April to June, we found it common on the rough shore ledges between tides and above high-water mark at Castle Island, Bailey Bay, and other localities, where also its recently cast-off shells were often found considerably above high tide, as they had been left by the crabs. In 1901, at the same season, we could not find a single specimen, even of the cast-off shells, at the same localities, or elsewhere. Probably the species had been greatly reduced in numbers by the unusually cold period in the preceding February, when great quantities of the native fishes also perished.*

It was represented by a single specimen in Mr. Goode's collection. It was also taken by the Field Nat. Hist. Museum expedition in 1905, and by Prof. T. Kincaid, 1903. A small specimen is also in the collection of the Bermuda Biological Station, 1903.

It has an extensive geographical range. On the Atlantic coast it ranges from South Carolina to Brazil, and throughout the West Indies. Pernambuco, Brazil (M. J. Rathbun). On the eastern side of the Atlantic it extends from the Mediterranean to South Africa. St. Helena, Ashantee (Benedict). Hong Kong, Bonin Is., Hawaiian Is., Loo Choo Is, and Madeira (Stimpson).

At Woods Hole, Mass., a single specimen was taken among barnacles from the bottom of a vessel that had just arrived from Swan Island, West Indies, Jl. 14, 1887. (t. S. I. Smith in MSS.)

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* See p. 320 above, and the Bermuda Islands, i, p. 94 [506], 1901.

Percnon planissimum (Herbst), M. J. Rathbun. *Flat Crab.*

Cancer planissimus Herbst, Naturh. Krabb., p. 3, pl. lix, fig. 3, 1804.

Acanthopus planissimus Stimpson, op. cit., p. 104 [242], 1860; Crust. N. Pacific Expl. Exp., Smithsonian Misc. Coll., xlix, p. 123, 1870 (1907). (descr. colors) Bonin Is.

Acanthopus Gibbesii Milne-Edw., Mel. Carcin , p. 146.

Leiolophus planissimus Miers, Catal. Crust. N. Zealand, p. 46, 1876.

Percnon planissimum Rathbun, Dec. Crust. W. Africa, Proc. U. S. Nat. Mus., xxii, p. 281, 1900; Brach. and Macr. Porto Rico, p. 19, 1901. Verrill, these Trans., vol x, p. 575, 1900.

Plate X, Figure 3. Plate XII, Figure 4.

Easily recognizable on account of its very flat, smooth body, and the slits in the front and in the eye-sockets. Its structure is admirably adapted to its habit of living in the confined spaces under stones.

In life the carapace is usually variegated or mottled with brown, pinkish flesh-color and salmon; there is generally a median longitudinal stripe of bright pale blue; the legs are banded with reddish brown and light pink. Ventral side of body pale blue; of legs pale pink (C. S. V.).

One female taken in April, 1901, carried eggs; also one taken in midsummer, by Prof. Kincaid.

Measurements of Bermuda specimens.

Number	Sex	Carapace length	Carapace breadth	Front width	Chelæ length	Chelæ height
30	♂	25.5	23.0	--	12.5	8.4
3005	♀	25.0	24.0	10	9.0	5.0
3005*a*	♂	20.0	18.0	8	7.5r.	5.0
----	♂	20.0	17.0	6	7	4.0
Figured	♀	19.0	16.5	6	5	3.5

The chelæ are feeble in the females but large in the males. In the males the two are unequal; the large chela has a large and long tuft of soft hairs on inside of merus.

It was found very commonly by us in 1898 and 1901, on many rocky shores under stones at about low-tide level. It was in the collections of J. M. Jones; G. Brown Goode; Prof. Kincaid, 1903; Field Museum Exped., 1905; Bermuda Biological Station, 1903, and others.

It is widely distributed throughout the West Indies to Brazil. Azores; Spain; Madeira; West Africa and South Africa; Mauritius to Japan, and Hawaiian Is., Bonin Is. Cape St. Lucas to Chili (Rathbun). Colon (Yale Mus.).

Superfamily or tribe **CYCLOMETOPA=CANCROIDEA** (see p. 14).

Family Pilumnidæ.

*Key to the Bermuda genera of the family Pilumnidæ.**

A. The ridges that define the efferent branchial channels, if present, are usually low and are confined to the posterior part of endostome, never reaching to anterior boundary of buccal cavern.

B. Fronto-orbital border less than half the greatest width of carapace.

C. Antero-lateral borders of carapace sharp, crest-like; upper border at least of arms, and of fourth, fifth, and sixth segments of legs sharp and crest-like ..... *Platypodia*

C′. Antero-lateral borders of carapace and upper borders of legs not crest-like

D. Antero-lateral borders divided into lobes or teeth.

E. Carapace usually conspicuously lobulate, granulate, and hairy, chelipeds and legs also granulate and hairy ..... *Actæa*

E′. Carapace, chelipeds, and legs not sharply granulate and hairy.

F. Fingers sharp-pointed, not hollowed ..... *Cycloxanthops*

F′. Fingers blunt-pointed, hollowed at tip. ..... *Xanthodius*

B′. Fronto-orbital border half or more than half the greatest width of the carapace. (True of American species of *Liomera*.)

C. Carapace transversely oval.

D. Ambulatory legs with upper margins of the carpal joint bearing a horned or lunate crest ..... *Heteractæa*

D′. Ambulatory legs with upper margins smooth or nearly so.

E. Antero-lateral teeth strong, greatly projecting. Carapace deeply areolated ..... *Leptodius*

E′. Antero-lateral teeth small, little projecting. Carapace slightly or not at all areolated. Carapace without transverse granulated lines. Fingers somewhat hollowed at tip ..... *Liomera*

C′. Carapace more or less hexagonal, or subquadrate.

D. Ambulatory legs spinulose.

D′. Ambulatory legs not spinulose.

F. Front of moderate width. Postero-lateral margins not strongly converging ..... *Eupanopeus*

A′. The ridges that define the efferent branchial channels extend to anterior boundary of buccal cavern and are often very strong.

B′. Fronto-orbital border just about half or less than half greatest breadth of carapace, which is broad and transversely oval.

C. The basal antennal joint does not nearly reach the front.

C′. The basal antennal joint reaches the front.

D. Anterior margin of merus of outer maxillipeds not notched. *Eurytium*

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* This table is taken from that of Miss M. J. Rathbun (Brachyura and Macrura of Porto Rico), with some alterations and omissions. It includes two additional genera (*Heteractæa* and *Lobopilumnus*).

B'. Fronto-orbital border much more than half greatest breadth of carapace.
C. Carapace nodose ..... *Lobopilumnus*
C'. Carapace not nodose.
D. Merus of external maxillipeds as long as or longer than broad.
E. Fronto-orbital border about two-thirds greatest breadth of carapace ..... *Pilumnus*
E'. Fronto-orbital border much more than two-thirds greatest breadth of carapace; arm scarcely projecting beyond lateral border of carapace ..... *Eriphia*
D'. Merus of external maxillipeds about twice as broad as long.. *Domecia*

Platypodia spectabilis (Herbst) Rathbun. *Calico Crab; Bandana Crab.*

Cancer spectabilis Herbst, Natur. Krabb., ii, 153, pl. xxxvii, f. 5, 1794.
Cancer lobata M.-Edw., Hist. Nat. Crust., i, p. 375, 1834.
Attergatis lobatus Stimpson, Ann. Lyc. Nat. Hist. N. York, vol. vii, p. 202 [74], 1860.
Lophactæa lobata A. M.-Edw., N. Arch. Mus., Mem., i, p. 249, pl. xvi, fig. 3, 3*a*; Miss. Sci. Mex., p. 242, 1879. Rankin, op. cit., p. 529, 1889.
Caneer venustus Desb. & Scramm., Crust. Guadeloupe, p. 23 (*t.* A. M.-Edw.).
Platypodia spectabilis M. J. Rathbun, Amer. Inst. Jamaica, i, p. 13, 1897; Brachyura and Macrura Porto Rico, p. 26, 1901. Verrill, Trans. Conn. Acad., xi, p. 17, pl. i, fig. 2, 1901 (descr. colors).

FIGURE 10. PLATE XIV, FIGURE 6.

This is a small and rather rare species, easily distinguishable by the form of its carapace and its remarkable coloration, which appears to be highly protective when the crab lives among the common bright

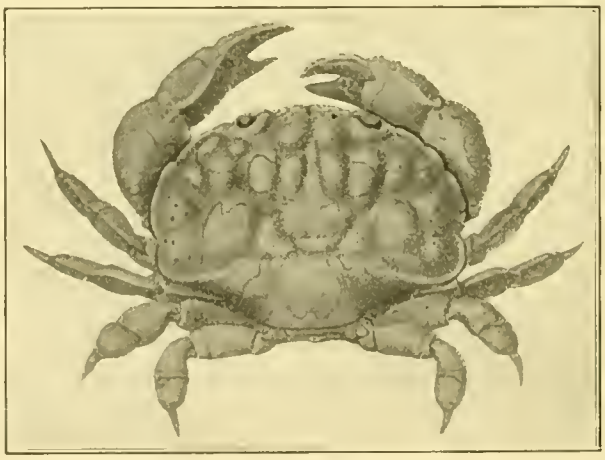

Figure 10.—Calico Crab, *Platypodia spectabilis*, enlarged about 1½ times. After A. M.-Edw.

red and orange-colored sponges (*Tedania ignis*), actiniæ, etc., with which it agrees well in colors, while their irregular arrangement serves to break up the outline of the carapace.

A specimen taken in Castle Harbor, near Walsingham Bay, May 5, 1901, had the colors as follows: Carapace deep orange red, varying to scarlet, with irregular paired spots of pale orange, concentrically bordered with white and purplish brown. The spots are of various sizes and shapes on the carapace, the larger ones often centered with smaller spots of purplish brown. On the chelipeds and legs the spots become transverse, and are mostly at the joints, and larger above than below. Dactylus and thumb black. Sternum orange with margined spots at the bases of the legs. Abdomen with two large spots of the same kind beneath, and smaller ones on the basal segments. Eye-stalks pale orange, with a purplish brown spot on the upper side.

Our largest specimens had the following coloration in life: The carapace was bright orange-red, with pale, particolored, broad, irregular streaks, blotches, and angular or rounded, often ocellated spots of variable sizes. The larger patches of color are frequently quite unsymmetrically developed. The ocellated spots have a small bright yellow center, surrounded by a broad circle of white, which is bordered externally with bright blue and enclosed by a narrow black line. Sometimes similar but smaller ocellated spots occur on the larger pale blotches, in lines and groups, or singly, while others are scattered on the ground-color. The chelipeds and legs are similarly colored, but on them the spots mostly take the form of half bands, with angular patches at the joints. Claws tipped with black. Small specimens are paler. (A. H. V.) These colors soon fade in alcohol.

Measurements of Bermuda specimens.

No.	Sex	Carapace length	Carapace breadth	Front width	Chelæ length	Chelæ height
4007	♂	16	24	6	r. 13 l. 14	r. 8 l. 8
4008	♂	13	18	5	l. 11	6
4008*a*	♀	9.5	13	4	l. 6	4

This handsome species is rare at the Bermudas. It occurs among rocks and cavernous corals, sponges, etc. Sometimes found on the reefs. We found it only in April, 1901 (five specimens), on serpuline atolls, near Hungry Bay; Castle Harbor, etc. (coll. A. H. Verrill).

A single specimen occurred in the collection of Mr. Goode. It was taken at Hungry Bay by the Bermuda Biol. Station, July, 1903.

Several specimens were also taken in 1906 by A. H. Verrill at Dominica Island, where they occurred in the cavities in and beneath

large reef corals. It has been recorded from Florida and through the West Indies to Brazil. Fernando de Noronha (Pocock). Colon (Stimpson). Porto Rico (Rathbun).

Actæa setigera (M.-Edw.) A. M.-Edw.

Xantho setiger M.-Edw., Hist. Crust., i, p. 390, 1834.

Actæa setigera A. M.-Edw., Nouv. Arch. Mus., i, p. 271, pl. xviii, fig. 2, 1865; Miss. Sci. Mex., v, p. 244, 1879. Rankin, op. cit., p. 529, 1900. M. J. Rathbun, Brach. and Macr. Porto Rico, p. 34, 1901.

FIGURE 11.

While living this small crab is densely covered with short hairs to which fine white shell-mud adheres, often effectually concealing it when resting on the bottom. When cleaned the color is reddish brown to purplish red, with paler legs. The carapace and legs are closely granulated beneath the hairs; the dactylus of the chelæ is deeply grooved and hairy.

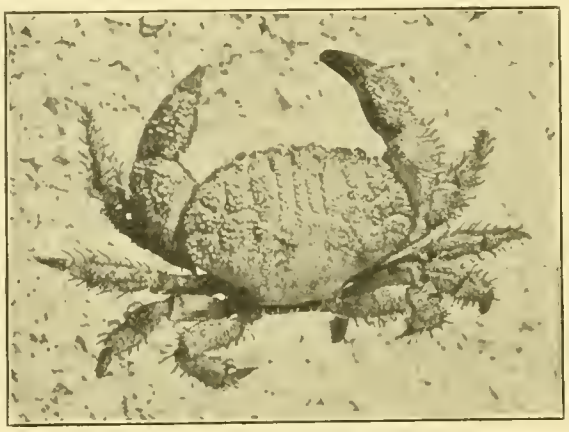

Figure 11.—Hairy Crab, *Actæa setigera*, nat. size. Phot. A. H. V.

Measurements of Bermuda specimens.

No.	Sex	Carapace length	Carapace breadth	Front width	Chelæ length	Chelæ height
812*a*	♂	19	30	6	r. 16 l. 16	9 9
812*b*	♂	12	18	4	r. 10	5
29*a*	♂	20	29	5	l. 17 r. 15	9.5 8
0*b*	♀	21	31	5.7	16	8

It occurs in shallow water bays and on the reefs. Taken by nearly all Bermuda collectors. Good specimens were in the collection of J. M. Jones (812, *a*, *b*). We found it common on rocky shores, usually under stones or in crevices. A small specimen was taken on

the Challenger Bank in 28 fathoms, by the party from the Field Museum Nat. Hist., Oct. 1905.

It ranges from Florida to the Lesser Antilles. It is common in the West Indies. Colon (Yale Mus.).

Cycloxanthops denticulatus (White) Rathbun.

Xantho denticulata White, Ann. Mag. Nat. Hist., 2d s., ii, p. 285, 1848 (*non* Stimpson). Smith, Proc. Boston Soc. Nat. Hist., vol. xii, p. 274, 1869 (descr.); these Trans., ii, pp. 3 and 33, 1869 (Bermuda, Colon, and Brazil). A. M.-Edw., Miss. Sci. Mexico, Crust., p. 252, pl. xlv, figs. 2–2*b*, 1879. Rankin, op. cit., p. 529, 1900.

Cycloxanthops denticulatus M. J. Rathbun, Ann. Inst. Jamaica, i, p. 14, 1897; Proc. U. S. Nat. Mus., xxi, p. 590, 1898; Proc. Wash. Acad. Sci., ii, p. 138, 1900; Brach. and Macr. Porto Rico, p. 27, 1901.

Plate XIV, Figure 8. Plate XXVII, Figure 7.

In life this species is generally some shade of red, purplish red or salmon. "Our specimens are usually reddish salmon, or pink; on the front part of the carapace there is often a red spot. Under surfaces whitish, with some pale brown spots on the abdomen. Chelæ pinkish brown, their tips dark brown or nearly black." (C. S. V.)

The carapace of an unusually large specimen from Brazil, was 16.6^{mm} long, by 26.5^{mm} broad; ratio, 1 : 1.6. (Smith.)

Measurements of Bermuda specimens.

No.	Sex	Carapace length	Carapace breadth	Front width	Chelæ length	Chelæ height
3137*a*	♂	16	25	6	r. 17 l. 16.5	9 7.3
3137*b*	♂	14.5	22	5	r. 15 l. 14.5	8 6
4014	♂	15	24	6	r. 18.5	9.5
4013	♀	14	22	5	r. 13 l. 12	7 6.5

In all our specimens the right chela is the larger. It is easily distinguished by the small, sharp marginal denticles.

We found this species rather rare at Bermuda. It lives under stones at low tide and among dead corals on the reefs. It was also in the early collections of J. M. Jones and G. B. Goode (Yale Mus.), and in the collection made by the Bermuda Biological Station, 1903.

Its range extends from South Carolina and Florida through the West Indies to Colon (Smith), and Rio Janeiro (Dana). Abrolhos Is., Brazil (Smith); Maceio (Rathbun); Cumana (Stimpson). Near Vera

Cruz (Edwards). According to Stimpson it makes a nest of mud among the roots of mangroves.

Xanthodius parvulus (Fabr.) M. J. Rathbun.

Cancer parvulus Fabr., Entomol. Syst., ii, p. 451, 1793 (*t.* Rathbun). (Not *Xantho parvulus* M.-Edw., nor *Panopeus parvulus* Ben. and Rath.)

Chlorodius americanus Saussure, Mem. de la Soc. Phys. et d'Hist. Nat. Genève, vol. xiv, p. 430, pl. i, fig. 5, 1857.

Xanthodius americanus Stimp., Notes on N. Amer. Crust., Ann. Lyc. Nat. Hist., N. York, vii, p. 209 [81], 1860.

Leptodius americanus A. Milne-Edw., Miss. Sci. Mex., v, i, p. 269, 1880. M. J. Rathbun, Proc. U. S. Nat. Mus., xvi, p. 536, 1893.

Xanthodius parvulus M. J. Rathbun. Brach. and Macr. of Porto Rico, p, 27, 1901. Verrill, Trans. Conn. Acad., xi, p. 576, 1901.

Figure 12. Plate XIV, Figure 4.

Average size of adults: carapace about 15^{mm} long; 24.5^{mm} wide; front 6^{mm} wide.

The single adult specimen in the Museum of Yale University, from the collection of Dr. F. V. Hamlin, 1877, has been determined by Miss Rathbun by direct comparison with a photograph of the original type of Fabricius. It is evidently a rare species at the Bermudas, for it was not found in any of the later collections. Probably it lives under stones or in burrows.

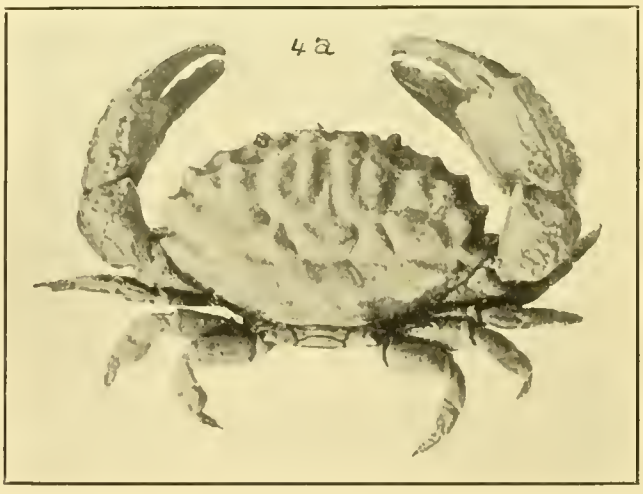

Figure 12.—*Xanthodius parvulus* from Bermuda. × about 2. Phot. A. H. V.

It ranges from the Florida Keys and West Indies to Brazil. Florida and Barbados (Stimpson); Hayti (Saussure); Bahamas, Porto Rico, Curacao, etc. (Rathbun); Fernando Noronha (Pocock).

Heteractæa ceratopus (Stimp.) A. M.-Edw.

Pilumnus ceratopus Stimpson, Annals Lyc. Nat. Hist., New York, vii, p. 215 [87], 1860; and vol. x, p. 109, 1871.

Heteractæa ceratopus A. Milne-Edw., Sci. Miss. Mexico, part v, i, p. 300, pl. lii, figs. 3-3*d*, 1880. Kingsley, op. cit., 1879, p. 396. Rankin, Crust. Bahamas, Annals N. Y. Acad. Sci., xi, p. 232, 1898. Verrill, Trans. Conn. Acad., x, p. 575, 1900 (Bermuda).

FIGURE 13.

This is easily recognized by the very spinose character of the marginal teeth of the carapace and the spiniform tubercles of the chelipeds. The dactylus and thumb are black; the distal part of the manus light red.

Measurements.

No.	Sex	Carapace length	Carapace width	Front between orbits	Chelæ length	Chelæ height	Locality
3145	♂	17	28	10.5	r. 20 l. 17	12 8	Bermuda
4067	♂	9	13	5.0	l. 8.5	5	Dominica

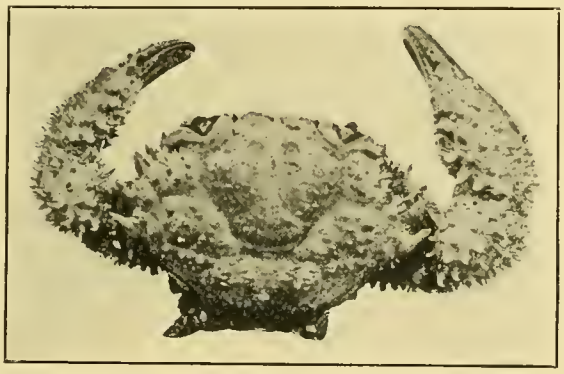

Figure 13.—*Heteractæa ceratopus*, ♂ from Bermuda, about nat. size. Phot. by A. H. V.

This species is apparently very rare at the Bermudas. It is not contained in any of the recent collections examined, nor was it in the early collections of Jones and Goode. One adult specimen was taken by our party in 1898.

It ranges from Florida to Antilles. Florida (Stimpson). Bahamas (S. I. Smith, coll. Bryant). Guadeloupe (Stimpson). Dominica I. (A. H. Verrill, 1906.)

Leptodius floridanus (Gibbes) A. M.-Edw.

Chlorodius floridanus Gibbes, Proc. Am. Assoc. Adv, Sci., iii, p. 175, 1850. Stimpson, Notes on N. Amer. Crust., Annals Lyc. Nat. Hist. N. York, vii, p. 209. S. I. Smith, Crust. Brazil. these Trans., ii, p. 3, 1869 (measurements). Kingsley, Proc. Acad. Nat. Sci., Philad., for 1879, p. 395. Rankin, Ann. N. York Acad., xi, p. 231, 1898.

Leptodius floridanus A. M.-Edw., Miss. Sci. Mex., v. vol. i, p. 268, pl. xlix, figs. 2, 2*a*, 1880. M. J. Rathbun, Proc. Wash. Acad. Sci., ii, p. 139, 1900 (Brazil); Proc. U. S. Nat. Mus., xvi, p. 536; Brachyura and Macr. Porto Rico, p. 27, 1901. Verrill, these Trans. x, p. 575, 1900 (Bermuda).

Chlorodius limosus Desb. and Schramm, Crust. Guadeloupe, p. 30 (*t.* A. M.-Edw.).

Plate XIV, Figure 7.

This is easily distinguished from most of the allied species by the strongly areolated carapace, large lateral teeth, and prominent bilobed front. The upper side of the chelæ is rough with irregular elevations and small rounded tubercles. The smaller specimens often closely resemble *Eupanopeus bermudensis* of similar size, and the young of *E. serratus*, but the areolations of the carapace are stronger and the frontal lobes are more prominent, with a deep notch between them, while the tubercles appear on the chelæ in very young individuals. The tips of the chelæ are excavate or spoon-like even when very young. It is variable in color, but is usually mottled or varied with dull red or reddish brown.

Measurements of Bermuda specimens.

No.	Sex	Carapace length	Carapace breadth	Front width	Chelæ length	Chelæ height
4000*a*	♀	20	28.5	8	r. 19 l. 17	10 8
4001	♀	20	29.5	8	l. 18 r. 17	9.5 8
4002*a*	♂	18	27	7	l. 19	10
4004	♂	18	27	7	r. 18 l. 20	r. 9 l. 11
4019	♂	18	26	9	r. 17 l. 16	6 8
3030	♂	17	25	6.5	l. 17	9

No. 4001 was carrying eggs April, 1901.

This species is common on rocky shores under stones and on the reefs in the crevices and beneath dead corals. Many specimens were taken by the Yale parties in 1898 and 1901. Several taken in April were carrying eggs. Others taken in midsummer by the Bermuda Biol. Station also had eggs. It has been obtained by nearly every collector in Bermuda (J. M. Jones, Mr. Goode, Professor Kincaid, Dr. T. H. Bean, etc.).

Its range is from Florida to Colon and through the West Indies to Brazil. New Providence in pools and under stones on the shore (Rankin); Florida, Colon, and Abrolhos Is. (Smith); Maceio, Brazil (Rathbun); Barbados (Benedict).

Liomera dispar (Stimp.) Rathbun.

Chlorodius dispar Stimp., Prelim. Rep. on Crust. Gulf Stream, Bull. Mus. Comp. Zoöl., ii, p. 140, 1870. Kingsley, Proc. Acad. Nat. Sci., Philad., for 1879, p. 395 (descr.).

Leptodius dispar A. M.-Edw., Miss. Sci., Mex., v, i, p. 271, 1880.

Liomera dispar M. J. Rathbun, Ann. Inst. Jamaica, i, p. 13, 1897; Brachyura and Macr. of Porto Rico, p. 25, 1901. Verrill, Trans. Conn. Acad., x, p. 577, 1900 (Bermuda).

Plate XIV, Figure 5.

A small and very rare species. Easily recognizable by its transversely elliptical and smooth carapace. The tips of the chelæ are jet black. The carapace in our specimens, preserved in alcohol for many years, is plain dull yellowish brown. Doubtless it has changed very much. Length of carapace about 8^{mm}, breadth 13.5^{mm}.

This has not been found in any recent collection. Two specimens in the Yale Museum were collected before 1877, by J. M. Jones (No. 3176). One has been given to the U. S. Nat. Museum. They were identified by Miss M. J. Rathbun.

Key West (Kingsley); Cuba (Stimpson); Bahamas; Porto Rico and Jamaica (Rathbun).

Eupanopeus M. J. Rathbun, 1898.

Panopeus (*pars*) H. M.-Edw., Hist. nat. Crust., 1834, and most subsequent writers. Benedict and Rathbun, The Genus Panopeus, 1891.

Eupanopeus M. J. Rathbun, Bull. Labr. Nat. Hist. State Univ., Iowa, iv, p. 273, 1898.

Artificial key to the Bermuda species of Eupanopeus.

A. No well-defined transverse groove near the distal margin of the carpus of the chelipeds.

B. Marginal teeth with front edge inclined forward; ratio of length to breadth of carapace about 1:1.35 to 1:1.50 ..... *Herbstii*

c. Last three marginal teeth acute, subequal in size, cusps of first two, or coalesced tooth, nearly equal in height. Flanks of carapace not convex ..... Var. *Herbstii*

c'. Last three marginal teeth unequal in breadth, not all divergent; cusps of first and second unequal in height. Flanks usually convex.

d. Third tooth notably large, and broadly rounded outwardly. Flanks convex, in a dorsal view. Front 4-lobed. Legs elongated.. Var. *minax*

d'. Third tooth not greatly enlarged; tip incurved or obtuse. Flanks usually somewhat convex. Legs not so elongated..... Var. *obesus*

B'. Marginal teeth thickened, with front edge not much inclined forward; 4th and 5th squarrose. Ratio of length to breadth of carapace about 1:1.30. Edge of front thickened, distinctly four-lobed ..... *americanus**

A'. A distinct transverse groove near distal end of carpus of chelipeds.

C. Third segment of male abdomen reaches coxal joint of 5th pair of legs; front not grooved. Fingers dark. Size rather large.

D. Third marginal tooth broadest, arcuate posteriorly; carpus of chelipeds smooth with deep groove ..... *occidentalis*

D'. Third marginal tooth dentiform, acute; carpus of chelipeds roughened. *serratus*

C'. Third segment of male abdomen does not reach the coxal joint of 5th pair of legs. Front prominent, 4-lobed, grooved. Fingers pale; size small ..... *bermudensis*

Eupanopeus Herbstii (Milne-Edwards), M. J. Rathbun.

Cancer panope Say, Jour. Acad. Nat. Sci. Phila., i, pp. 58, 447, pl. 4, fig. 3, 1817.

Panopeus Herbstii H. M.-Edwards, Hist. Nat. Crust., i, p. 403, 1834. DeKay, Crust. of N. Y., p. 5, pl. ix, fig. 26 (poor), 1844. Gibbes, Proc. Boston Soc. Nat. Hist., ii, pp. 63, 69, 1845. Stimpson, Amer. Jour. Sci. (2), xxix, p. 444, 1860. Smith, Proc. Boston Soc. Nat. Hist., xii, p. 276, 1869; these Trans., ii, p. 34, 1869; Rept. U. S. Comm. Fisheries for 1871–72 (1874), p. 547. Verrill, op. cit., p. 472 [178], 1874. A. M.-Edwards, Miss. Sci. Mexique, pt. 5, i, p. 308, pl. lvii, fig. 2, 1880. R. Rathbun, Fishery Industries of U. S., section i, p. 772, 1884. Benedict and M. J. Rathbun, The Genus Panopeus, Proc. U. S. Nat. Museum, xiv, p. 358, pl. xix, figs. 1, 2; pl. xxili, figs. 10–12, 1891.

Eupanopeus herbstii M. J. Rathbun, Bull. Labr. Nat. Hist. State Univ. of Iowa, iv, p. 273,1898; Proc. Wash. Acad. Sci., ii, p. 140, 1900; Amer. Naturalist, xxxiv, p. 138, 1900; Brach. and Macr. Porto Rico, p. 28, 1901.

Figures 14, *b*, 15. Plate XV, Figures 1, 2, 3; Varieties.

The common and more typical form of this species, which is generally distributed along the eastern coast of the United States, south of Cape Cod, especially on oyster beds, seems to be rather common in Bermuda. Most of the specimens that I have seen belong to this variety. This form, or variety, regarded as typical (var. *Herbstii*) usually has the postero-lateral margins or flanks of the carapace either straight or slight concave, and convergent, while in the other varieties they are usually distinctly convex, giving the posterior half of the outline a more elliptical form. The legs are rather short. The marginal teeth are inclined forward and acute, the third tooth being only a little broader and less acute than the rest, with the

* Not positively known from Bermuda, but perhaps confused with *Herbstii*, from which it differs but slightly.

posterior edge more convex; the coalesced first and second teeth have the two cusps prominent and nearly equal in height; the second is obtuse and broader. The front is somewhat produced and is distinctly 4-lobed or sinuous; the edge is often upturned and granulated in the adults.

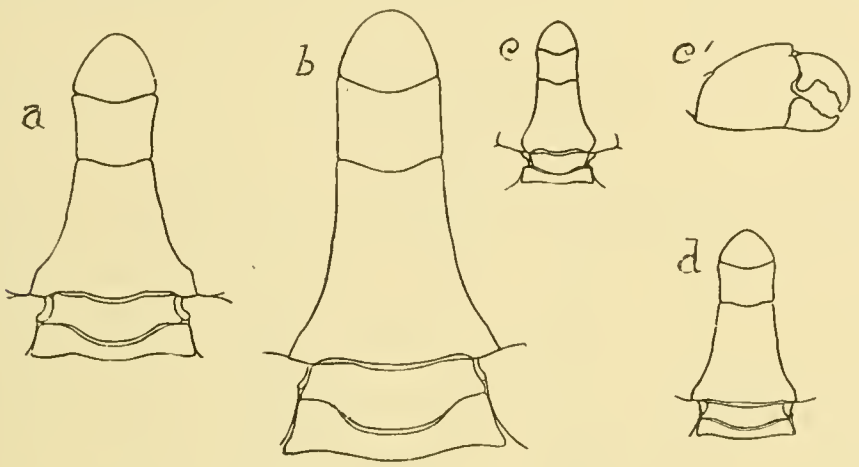

Figure 14.—Male abdomens of *Eupanopeus*: *a*, *E. occidentalis*; *b*, *E. Herbstii*; *c*, *E. bermudensis*; *c'*, its larger chela; *d*, *E. serratus*. All enlarged, after Benedict and Rathbun.

The carpus of the chelipeds is granulated, but nearly smooth to the naked eye, usually with a slight undulation or depression in place of the distal groove, but in some this is entirely obsolete. The carapace is somewhat uneven, with the areolation not much raised but well marked; slight transverse rugæ are usually present; the surface is usually finely punctate and granulate, but in some examples it is transversely rugose and more granulose. The color is variable, but usually is yellowish or olive-yellow, mottled more or less thickly with red or red-brown. The fingers are blackish, varying to dark liver-brown, and below, the dark color is apt to extend backward on the manus, a little beyond the base of the dactylus.

A specimen (No. 4016) taken at Long Bird Island, April 19, 1901, in life had the carapace curiously variegated with gray, white, and blackish brown, and with patches of orange in the middle, near the front edge. Chelipeds thickly spotted and specked with bluish gray, and with a patch of orange on the back of the carpus and chela.

The ratio of length to breadth of the carapace, according to the measurements of Prof. S. I. Smith,* varies from 1:1.33 to 1:1.48.

* Proc. Bost. Soc. Nat. History, xii, p. 277.

Our No. 470, which was labelled as *E. Herbstii* by Miss Rathbun, has the ratios 1:1.33. Therefore it has nearly the same proportions as *E. americanus*, in which they are usually about 1:1.3. The difference in form is, therefore, not very reliable. The largest example mentioned by Benedict and Rathbun had the carapace 40mm long and 62mm wide, ratio 1:1.55. It was about the same size as the type of our var. *minax*.

Measurements.

No.	Sex	Carapace length	Carapace breadth	Front between orbits	Chelæ length	Chelæ height	Locality
470	♂	21	28	10	l. 21 r. 19	14 10	Colon
Figd.*	♂	26	35.5	12.5	r. 29 l. 21	18 12	Egmont Key
4042	♀	20	28	11	r. 17 l. 18	7.5 10	Bermuda
4043	♀	17	22.5	9	r. 15	10	"
4018	♂	16	22	9	l. 16	10	
4016		15.5	20.5	8.5	r. 14	8.5	"
41*b*	♂	34.8	50.5	——	r. 35 l. 39	12 22	"

* This belongs to the var. *obesus*. It is the figured specimen, pl. xv, fig. 1.

This is much more active than most species of *Eupanopeus*. In some cases it may be seen actively running about on the stony beaches, as at Spanish Point, in March, 1901, where it was found in considerable numbers and "very lively" by A. H. Verrill. It was not found at any other place in such numbers. These were of medium size and rather bright colors (Nos. 4042, 4043). They were purplish, varied with yellow and yellowish white; on the under side, pale yellow mottled with bright lavender. (A. H. V.)

In the Bermudas it occurs mostly under stones and dead corals on rocky shores and on the reefs. It was obtained by Jones, Goode, Kincaid, and by the Yale parties of 1898 and 1901, but usually in small numbers or singly. This species, as a whole, ranges from Southern New England to Florida, Texas, Colon, and through the West Indies to Brazil (coll. Yale Mus.). It is abundant from Cape Hatteras southward. The typical variety seems to occur, as well as the var. *obesus*, throughout its entire range.

Eupanopeus Herbstii, var. **obesus** (Smith).

Panopeus herbstii, var. *obesus* S. I. Smith, Proc. Boston Soc. Nat. Hist., xii, p. 278, 1869. Coues, Proc. Acad. Nat. Sci. Philad. (3), i, p. 120, 1871. Kingsley, Proc. Acad. Nat. Sci. Philad., p. 318,1878. A. M.-Edwards, Miss. Sci. Mexique, pt. 5, i, p. 309, 1880, pl. lvii, figs. 2, 2*a*. Benedict and Rathbun, The Genus Panopeus, op. cit., p. 359, 1891, pl. xix, fig. 2; pl. xxiii, fig. 11.

FIGURE 14, *b*. PLATE XV, FIGURE 1.

This is an unusual form in collections from Bermuda. It differs from the preceding chiefly in its more elliptical form, due to the convexity of the flanks or posterior branchial areas, a character indicating, perhaps, enlarged gill-chambers and gills. Benedict and Rathbun (op. cit., 1891) state that this variety was found commonly on the Carolina coasts in holes above high tide, and not extending into the water, while the common form was found in the same vicinity on the oyster beds and below tide. This difference in habit may well be associated with a change in the capacity of the branchial chambers. Other characters are found mainly in the marginal teeth. In this form the teeth are broader, blunter, and less prominent; the coalesced first two are more unequal in size and prominence; the third tooth is broader and more arcuate posteriorly.

Measurements of Eupanopeus Herbstii, var. obesus, from Bermuda.

		Carapace		Front between	Chelæ	
No.	Sex	length	breadth	orbits	length	height
1903*a*	♂	28	39	14	l. 28	15
1903*b*	♀	23.5	33	12	r. 25	12.5
4023		30	42	14	----	----

Prof. Smith's original description was as follows:

"Carapax strongly convex. Front broad, deflexed, not prominent, the edges as seen from above nearly straight, and not at all four-lobed. Post-orbital tooth not prominent, slightly separated from the second normal tooth of the antero-lateral margin by a very shallow sinus; remaining teeth of the margin not very prominent; the third broad, and its outer edge truncate; fourth broad, the anterior edge very short, but slightly hooked forward at the apex, and the outer edge slightly arcuate; last tooth very short, but acute, and its apex slightly curved forward. Inferior regions, chelipeds, etc., very nearly as in *Herbstii*. Color of alcoholic specimens, brownish olive, clouded and spotted with dull red on the anterior part of the carapax, and on the upper side of the chelipeds; fingers black or dark brown, lighter at the tips. In all the specimens the hands are spotted externally with red"

"Length of carapax in a male, 23.6^{mm}; breadth, 33.4^{mm}; ratio, 1:1.41."

"Egmont Key, Fla.; Col. E. Jewett. Aspinwall; F. H. Bradley.

Specimens from Egmont Key appear quite distinct from specimens of *Herbstii* from the same locality, having the carapax broader and much more convex, the teeth of the antero-lateral margin less prominent and somewhat different in form, and the coloration quite different; but specimens of *Herbstii*, in the Society's collection, from Bahama and Florida, approach quite closely to the variety, in the breadth and convexity of the carapax, the form of the teeth of the antero-lateral margin of the carapax, and even slightly in coloration."

The following measurements of three specimens from Maranhao, Brazil (coll. C. F. Hartt, 1870), occur in Prof. Smith's MSS. notes:

No.	Sex	Carapace length	Carapace breadth	Ratio
236*b*	♂	23.7	35.1	1:1.48
232*a*	♀	22.0	33.3	1:1.51
232*b*	♀	18.5	26.9	1:1.45

I have personally examined the original specimens described by Professor Smith (Yale Mus. coll.) and numerous others from various localities, which were also studied by Benedict and Rathbun.

Its range is essentially the same as that of var. *Herbstii*.

Eupanopeus Herbstii, var. or subspecies, **minax**, nov.

Plate XV, Figure 2.

A single large male was taken by us in 1901. This is a large, stout crab, for one of this group. Its legs appear to be relatively longer than in var. *obesus* and other allied forms. Its carapace is convex and more swollen on the flanks, with the postero-marginal outlines decidedly convex, when seen from above. Its antero-marginal teeth are relatively large and more prominent than in the related forms. The coalesced first and second teeth are not very unequal; the first is smaller, short, acute, triangular; the second, which is separated half way to base by a broad, regularly curved notch, is rather larger and broader, concave in front and convex posteriorly. On the left side these teeth are much more unequal, apparently due to some injury to the first. The notch between the second and third is narrow at bottom. The third tooth is especially large, wide, and broadly rounded, or arcuate outwardly; the fourth and fifth teeth have acute tips, directed obliquely outward and upward; the fourth has the anterior edge subtruncate and but little inclined forward, with the posterior edge arcuate; the fifth is a little shorter and narrower, thickened and triquetral at base, with a sharp tip

directed slightly forward. All the teeth have the outer edge thickened and granulous, curved upward. The front is distinctly four-lobed, the outer lobes much the smaller, separated from the inner by a sinuous curve ; inner lobes broadly arcuate, separated by a narrow deep notch ; the edges are thickened and rather coarsely granulous.

The areolation of the carapace is well marked with the areas convex. The surface is rather finely granulose. The chelipeds are very large and strong, with massive unequal chelæ, appearing nearly smooth to the naked eye, but closely and rather finely granulous under a lens, with numerous small shallow unequal pits on the chelæ, which, on the carpus, become shallow transverse or wavy furrows, separated by very slightly elevated finely granulous rugæ. The distal transverse groove is indicated only by a very shallow, ill-defined wave-like depression. The carpal tooth is large and conical. No perceptible dorsal carina on the manus.

The male abdomen differs somewhat from that of var. *Herbstii*, as figured. The penultimate segment is relatively shorter ; it is wider than long, so that the suture between it and the last segment is behind the sternal suture, instead of coincident with it. Its sides and the sides of the distal portion of the preceding segment are nearly parallel ; last segment broad ovate, rounded at the end, about as broad as long.

Fingers dark horn-color, the dark color of the propodus terminating in a regular curve, convex proximally, a little back of the articulation of the dactylus.

The general color of the upper surface of the dry specimen is dull red, becoming brownish red on the chelæ, and brighter orange-red on the carapace ; under surface dull yellow.

Measurements of type.

Length of carapace	41
Breadth of carapace	62
Front, between orbits	18
Length of right chela	53
Height of right chela	30
Length of merus, right chela	26
Length of left chela	51
Height of left chela	24
Length of merus, left chela	23
Total length of 1st pereiopods	76
Length of merus, 1st pereiopods	25
Length of carpus, extreme	13
Length of propodite, extreme	14
Length of dactylus	17

The type, which is the only specimen known, was caught in a baited fish trap in Harrington Sound, in shallow water, April, 1901.

The specimen which approaches most nearly to the type of this variety is a cast shell, found on the shore (fig. 15) and of which only the carapace was preserved. I have included its measurement with variety *obesus*, however, as a matter of convenience, though it differs from that in having larger and more squarrose marginal teeth, of which the second and third are obtusely rounded; and in having a prominent and distinctly 4-lobed front, as in *minax*, from which it differs, therefore, chiefly in the shorter second and third teeth, and the narrower and more rounded carapace. The flanks were convex and the

Figure 15.—*Eupanopeus Herbstii* variety *minax*. Carapace of No. 4023, × 1¼. Phot. A. H. V.

granulation pretty fine, except on the front. Ratio of length to breadth, 1:1.4; length of carapace 30^{mm}; breadth 42^{mm}; front 14^{mm}.

E. americanus (Saus.)=*E. areolatus* Rath., figure 16, differs very little from some of the forms of this species. Although it averages slightly narrower, there are specimens of *Herbstii* (No. 470 in our collection, see table) as narrow as some of those from Brazil, referred to this species by Miss Rathbun (in Coll. Yale Mus.). The lateral marginal teeth are a little less oblique and less concave in front, but in some specimens this distinction fails; indeed, the teeth of opposite sides of one specimen may sometimes differ considerably in outline, or about as much as the species differ in this particular. But in this form the teeth are more thickened at base above, and are rather more granulous at the edges. The fourth and fifth teeth are more squarrose, and the tips are turned upward. The third tooth often differs but little from the others in size, but its tip bends forward and the outer margin is convex; it is not always as large as

the fourth ; the fifth is often smaller than the fourth. The front is a little more produced in the middle and is more evidently 4-lobed, the outer small lobe being more distinct. The distal groove on the carpus is sometimes distinct, but ill-defined ; in other cases it is lacking ; this variation may occur on the two chelæ of an individual. A Brazilian specimen (No. 236, Yale Mus.), studied both by Prof. Smith and by Miss Rathbun, has the carapace 21^{mm} long ; 28^{mm} wide ; ratio 1:1.33.

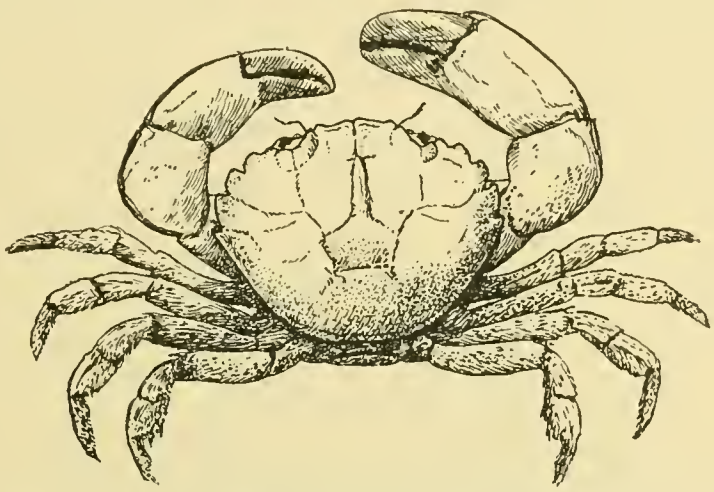

Figure 16.—*Eupanopeus americanus*, nat. size. After Benedict and Rathbun (as *P. arcolatus*).

Some of our Bermuda specimens may belong to this species, if it be really distinct.

Eupanopeus occidentalis (Saus.) Rathbun.

Panopeus occidentalis H. de. Saussure, Rev. et Mag. de Zoöl. (2), 9, p. 502, 1857 ; Mem. Soc. Phys. Genève, xiv, p. 431, pl. i, fig. 6, 1857. Stimpson, Amer. Jour. Sci. (2), 27, p. 446, 1859. S. I. Smith, Proc. Boston Soc. Nat. Hist., xii, p. 279, 1869. E. v. Martens, Arch. für Natur., xxxviii, p. 90, 1872. A. M.-Edw., Miss. Sci. au Mexique, pt. 5, i, p. 310, 1880 ; Bull. Mus. Comp. Zoöl., viii, p. 13, 1880. Benedict and Rathbun, Proc. Nat. Mus., xiv, p. 360, pl, xx, fig. 3 ; pl. xxiii, fig. 14, 1891.

Eupanopeus occidentalis Rathbun, Bull. Labr. Nat. Hist. Univ. Iowa, iv, p. 273, 1898 ; Proc. Wash. Acad., ii, p. 140, 1900 ; Crust. Porto Rico, p. 29, 1901.

Figure 17. Plate XVI, Figure 2.

Antero-lateral teeth slightly elevated ; their anterior margins truncate ; the three posterior teeth are pointed ; first tooth separated from the post-ocular tooth by a rather deep sinus, which, however, does not divide the coalesced tooth to its base. Front produced, thin, slightly depressed, with a median fissure, each lobe slightly

emarginate, giving the front a somewhat four-lobed appearance. Median lobes more produced; lateral lobes faint. Space between the two fissures of the upper orbital margin slightly rounded, interrupting the regular curve of the orbit; external hiatus widely V-shaped and deep. The inner suborbital angle forms a prominent tooth; a rather deep sinus divides this from the lobe which reaches to the external fissure; lower orbital margin produced.

Abdomen of the male wider than in *herbstii*, outline concave, penultimate segment widest at its distal end. Coxæ of fifth pair of feet in broad contact with third abdominal segment. Seventh segment of sternum shows but little.

The marginal depression on the carpus near the articulation with the hand is wide and deep. In some specimens the carpus is finely

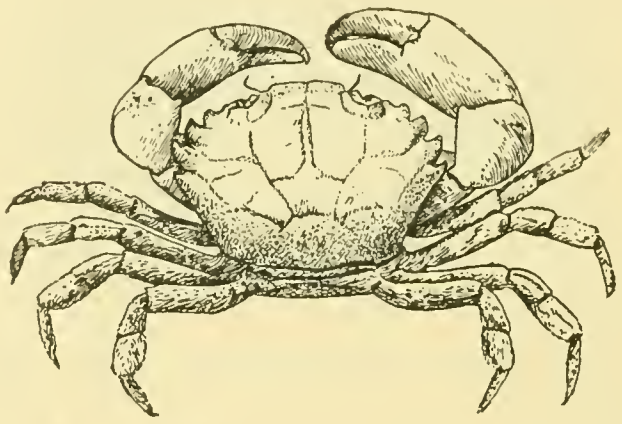

Figure 17.—*Eupanopeus occidentalis*, nat. size. After Benedict and Rathbun.

granulate; in others the granules are thrown up in slight rugæ. The hand varies in much the same way; in some specimens finely granulate; in others, thrown up in rugæ as on the carpus. In the latter case the hand is always much smoother than the carpus in the same specimen. Fingers brown or horn-color, shading to clear white at the tips. There is a large tooth at the base of the dactyl of the large hand.

The color on the immovable finger does not extend beyond the line of color on the movable finger; while in *Herbstii* it usually extends considerably beyond.

This species closely resembles *E. Herbstii*, as shown by the above description, and is easily confounded with it. The most important distinctive character seems to be the much more distinct distal groove on the carpus, but this varies. In *Herbstii* it is sometimes

evident on one cheliped and entirely lacking on the other, but it is always, when present, ill-defined. The marginal teeth have nearly the same outlines ; the front edge is a little less concave, and consequently the tips are not so much incurved, but this character is also variable in both species. The marginal teeth are, however, thicker vertically. The front is a little more prominent in the middle, and the median notch is less distinct. The specimen figured (No. 3021) was identified and labelled as this species by Miss Rathbun, several years ago. It was collected at Hamilton by Dr. C. Hartt Merriam, April, 1881, and carried eggs. The ratio of length to breadth is 1:1.3.

Measurements.

No.	Sex	Carapace length	Carapace breadth	Front between orbits	Chelæ length	Chelæ height	Locality
3021	♀	17.5	23.5	9	r. 18	10	Bermuda
3264	♂	16	23	8	r. 16 l. 14	9.5 7.5	Florida Keys

This species is not common in Bermuda, and is not contained in most of the collections. It was first obtained by Dr. Merriam, in 1881 (see above).

Its range extends from S. Carolina through the West Indies to Pernambuco, Brazil.

Eupanopeus serratus (Saussure).

Panopeus serratus Saussure, Rev. et Mag. de Zoöl., (2), ix, p. 502, 1857 : Mém. Soc. Phys. Genève, xiv, p. 432, pl. i, fig. 7, 1857. Stimpson, Amer. Jour. Sci. (2), xxvii, p. 446, 1859. Smith, Proc. Boston Soc. Nat. Hist., xii, p. 280, 1869. E. v. Martens. Arch. für Natur., xxxviii, 90, 1872. A. Milne-Edw., Miss. Sci. Mexique, pt. 5, i, p. 311, 1880 ; Bull. Mus. Comp. Zoöl., viii, p. 13, 1880. Benedict and Rathbun, The Genus Panopeus, Proc. U. S. Nat. Mus., xiv, p. 371, pl. xxiv, figs. 3, 4, 1891.

Panopeus Herbstii, var. *serratus* Miers, Rep. Voy. Chall., Zoöl., xvii, p. 129, 1886.

Eupanopeus serratus Rathbun, Bull. Labr. Nat. Hist. Univ. of Iowa, iv, p. 273, 1898.

Figures 14,*d*, 18. Plate XVI, Figures 1, 5.

The following description is that of a young specimen :

Carapace convex, with rather well-marked areolets. Front very little produced, nearly straight, thin, with a line of granules on the edge, giving it a minutely denticulate appearance. Antero-lateral teeth sharp, the posterior three hooked forward. Sinus between the external angle of the orbit and the first tooth deep. External hiatus of orbit a large V-shaped opening. Subhepatic tubercle small but

well defined. Abdomen much like that of *occidentalis*. Seventh segment of sternum exposed. Coxæ of fifth pair of feet in contact with third abdominal segment. Length of carapace of a young specimen, 7^{mm}; width, 8^{mm}.

Carpus and hand coarsely and densely granulated, rugose above. Carpal spine sharp, pointing forward; fingers not gaping, a large tooth at the base of the dactyl on the large hand, and a tooth on the hand at the base of the dactyl. (Benedict and Rathbun, abridged.)

Figure 18.—*Eupanopeus serratus*, carapace and chelipeds of No. 3019, Yale Mus., × about 1.10. Phot. A. H. V.

An unusually large male (No. 3019, pl. 16, fig. 5), which was collected by our Yale Exped. of 1898, has been studied by Miss M. J. Rathbun, who furnished the following notes:

"Length 19.3^{mm}, width 27^{mm}, exorbital width 15.9^{mm}. Color in formaline, light red and white mottled; upper part of chelipeds a darker red; fingers a light horny brown, terminal third white. Third segment of abdomen reaching the coxæ of the last pair of legs.

This specimen demonstrates conclusively the distinctness of this species from *E. occidentalis;* all the lateral teeth are narrower and sharper; the areolations strongly marked; the surface rougher, the short transverse granulated lines more prominent and more numerous. The chelipeds, also, are rougher, especially the carpus."

A somewhat larger and still better male specimen was taken in 1901. (No. 4068, see pl. xvi, fig. 1.) This, after preservation for a few years in formol, and doubtless much faded, is pale flesh-color and yellowish white, with patches of brighter yellow on the carapace and chelipeds; the upper parts of the manus and carpus are pale

purple and yellow ; hairs on the legs and carapace yellow ; under parts and front of chelæ white; dactyl and thumb dark horn-color with pale tips.

The areolations of the carapace and the transverse granulated rugæ are even stronger than in the specimen just described, but otherwise the same; the marginal teeth are nearly the same, but a trifle larger and more acute. They are much thickened vertically at base and the posterior ones bend upward ; their edges and bases are thickly covered with strong granulations which bear long hairs ; the posterior tooth has a dorsal carina, granulated on its edge. The transverse ridges of the carapace and especially of the front are strongly granulated and bear long hairs in life. The frontal edge is convex, prominent, granulated, and divided by a narrow median notch ; each lobe is slightly sinuous, with the smaller, faint, outer lobe rounded at the external angle. The outer orbital tooth is prominent and acute, but smaller than the next and well separated from it by a wide concave notch.

An excellent ♀ specimen in the collection of Prof. Kincaid (1903), preserved with glycerine, is pale lemon-yellow with minute specks of red-brown on the carapace and chelæ; larger blotches of the same on the legs ; two brown hepatic patches; a distal band of paler yellow on the manus ; fingers smoky brown, pale at tips. The carapace in life was covered with rather sparse hairs and small tufts of longer ones ; the legs are hairy and with longer hairs on the front edge. The areolation of the carapace is rather strong, with rather numerous transverse rugæ. The carpus has a deep distal groove and also a series of irregular oblique grooves and granulated broken ridges. The chelæ have a slight dorsal longitudinal groove and very minute granules. (See fig. 5, *b*, pl. xvi.)

Measurements of Bermuda specimens.

No.	Sex	Carapace length	Carapace breadth	Front between orbits	Chelæ length	Chelæ height
3019	♂	19.3	27	9.5	r. 19.5 l. 18.5	11 8
1903*a*	♀	13	19	8	14	7.5
4068	♂	21	30	10.5	r. 24 l. 22	15 10

This appears to be a rather rare species at the Bermudas, or else it has been generally overlooked by collectors. Nor is it common in other regions.

Its known range is not extensive. Florida Keys (Benedict and Rathbun) ; St. Thomas (Smith).

Eupanopeus bermudensis (Ben. and Rath.) Rathbun.

Panopeus bermudensis Benedict and Rathbun, Proc. U. S. Nat. Mus., xiv, p. 376, pl. xx, fig. 2; pl. xxiv, figs. 14, 15, 1891. Rankin, Crust. Berm., p. 528.

Eupanopeus bermudensis Rathbun, Bull. Labr. Nat. Hist. Univ. Iowa, iv, p. 273, 1898; Proc. Wash. Acad. Sci., ii, p. 140, 1900; Brachy. and Macr. Porto Rico, p. 29, 1901.

Panopeus wurdemannii Ben. and Rathbun, The Genus Panopeus, op. cit., p. 372, pl. xxiv, figs. 6, 7, 1891 (*non* Gibbes t. M. J. Rathbun, 1900).

Figures 14, *c*, *c'*. Plate XIV, Figure 9; Plate XVI, Figures 3, 4.

This is a very common species, but small and easily overlooked. In life it is quite variable in colors. Many specimens were variegated with lighter and darker gray; others are olive-green or olive-brown, mottled with paler; some have red-brown patches, other were finely mottled with brown and gray on a whitish ground-color, so as to very closely imitate the color of the sand, etc. of its environment. A few were plain bright red-brown. The colors appear to be highly protective in most cases. The fingers are somewhat variable in color, but are usually pale, sometimes with a smoky brown tinge, especially on the proximal half.

The following is condensed from the detailed original description:

Carapace distinctly areolated, posteriorly as well as anteriorly; areolations with transverse lines and occasional small clusters of granules. Front much produced, rather deeply cleft in the center, the cleft rounding out into the median lobes which are produced at this point; outer angles of the front not produced in some specimens, and slightly in others; edge of front oblique, thickened, densely granulate, and showing a slight marginal groove; two fissures on the upper orbital margin.

First and second [post-orbital] teeth of the antero-lateral margin flat and thin; third and fourth thickened, with anterior margins concave and hollowed. The sulcus of the coalesced tooth varies greatly with the specimen. Second [post-orbital] tooth the largest, separated from the first by a wide and deep notch; its margin straight, pointing slightly forward and not at all hooked. The third tooth is much narrower than the second, and its posterior margin curves gradually backward to the bottom of the notch; fourth tooth much the smallest, sharp pointed, and directed nearly perpendicular to the median line.

Outline of male abdomen slightly concave. First and third segments comparatively narrow and of about equal width. Second

segment much narrower, showing the sternal plates. Coxæ of fifth pair of feet not in contact with anchylosed segment.

Carpi, chelipeds, and bases of the dactyls finely granulate; carpal depression well defined along the margin, and extending around to the tooth on the inner angle. Large cheliped very deep and rather thick ; fingers light brown ; in some specimens white. Ambulatory feet slender; dactyls very slender and hairy. (Bened. and Rathbun, abridged.)

The larger specimens and many of the smaller ones have the areolations of the carapace very conspicuous, and the transverse ridges are high and sharply cut or nearly perpendicular on the anterior side, with the crest granulated ; but in some specimens the ridges are obtuse with the front side sloping. The dorsal side of the carpus of the chelæ, especially of the smaller one, is grooved and roughened and often bears two or three rounded tubercles. The dactylus is strangely grooved above, or slightly bicarinate.

Measurements of Bermuda specimens.

No.	Sex	Carapace length	Carapace breadth	Front between orbits	Chelæ length	Chelæ height
4017*a*	♂	9	12	5.5	r. 10.5	5.5
4617*b*	♀	8	10.5	5	r. 7.5	4.5
——	♂	8	11	4.5	——	——
——	♀	6.5	8.5	4	6.5	3.5

Variety **sculptus**, nov. Plate xvi, figure 3.

The strongly sculptured specimens differ so much in appearance from the smoother ones that they might easily be mistaken for a distinct species, especially as they usually have also stronger marginal teeth, and the carpi of the chelipeds are rougher with about three small rounded tubercles, which are lacking in the smoother form.

The coalesced post-orbital tooth is often distinctly divided into two subequal denticles by a rounded notch ; in others the notch is very shallow, while in some it is lacking so that the whole forms a rounded or subtruncate lobe. I have, however, found these extreme variations on the opposite sides of a single individual.

This little species is very common at Bermuda, under stones at low-tide and in shallow water dredgings. It is often associated with the young of *Leptodius floridanus*, of the same sizes, which it often closely resembles, in form, in the areolations, and in the mar-

ginal denticles. But the latter, even when not over 8 to 10^{mm} across the carapace, has the tips of the chelæ concave or spoon-like; the post-orbital tooth is not coalescent with the next, and the front is a little more evidently bilobed.

The original types of this species were from Bermuda (coll. Goode, 1877). It was in the collection of J. M. Jones, and has been obtained by nearly all later collectors. We found it abundant in 1898 and 1901, at low-tide, associated with the young of several other species. Some specimens taken in April carried eggs, although less than 8^{mm} long (see No. 3280*a*, fig. 4, pl. xvi).

Its range extends from Florida to Maceio, Brazil. (Porto Rico and Maceio, Rathbun.)

Eurytium limosum (Say) Stimpson.

Cancer limosa Say, Jour. Acad. Nat. Sci. Philad., i, p. 446, 1817.

Panopeus limosus Milne-Edw., Hist. Nat. des Crust., i, p. 404, 1834. De Kay, Crust. of N. Y., p. 5, 1844. Gibbes, Proc. Acad. Nat. Sci. Philad., v, p. 23, 1850. Lucas, Hist. nat. des Crust., p. 90, 1851. Benedict and Rathbun, op. cit., p. 379, 1891.

Eurytium limosum Stimpson, Ann. Lyc. Nat. Hist., vii, p. 56, 1859, Kingsley, Proc. Acad. Nat. Sci. Philad., p. 319, 1878; xxxi, p. 394, 1879. A. Milne-Edw., Miss. Sci. Mexique, pt. 5, i, p. 332, pl. lx, fig. 2, 2*a*, 1880. Miers, Voy. Challenger, Zoöl., xvii, p. 141, 1886 (Bermuda). M. J. Rathbun, Amer. Naturalist, xxxiv, p. 128, 1900. Brach. and Macr. Porto Rico, p. 41, 1901.

Figure 19. Plate XIV, Figure 10.

Carapace very convex longitudinally, nearly straight transversely. Front much deflexed, composed of two lobes, the inner and outer angles alike and evenly rounded. A slight emargination in the coalesced tooth. Second tooth semi-lobate; third and fourth short, pointed, triangular. Carpal groove wanting. Fingers evenly dentate. In the larger cheliped there is a slight tooth on the dactyl, and also one on the manus. Appendages of male abdomen very much like those of *herbstii*.

In the fresh state this species is readily recognized and separated from all other crabs by the color. Carapace, a brilliant purplish blue; carpus and hand, bluish; proximal upper half of the dactyls of chelipeds, pink; remainder of fingers, porcelain white; lower portion of chelipeds and carpal tooth, orange-yellow. (Benedict and Rathbun, abridged.)

Length of carapace of a large specimen, 28^{mm}; width, 42.5^{mm}. The ♂ specimen from Bahia (pl. xiv, fig. 9, No. 4028) has the carapace 9^{mm} long, 14^{mm} wide; front 5^{mm}; larger chela 10^{mm} long, 5^{mm} high.

This interesting species appears to be rare at Bermuda, but this may be due to its living in places seldom visited by collectors. It usually inhabits holes excavated in the muddy or marshy banks of inlets, about high-tide level. It was recorded from Bermuda by Miers, in Voyage "Challenger"; taken in the mangrove swamp at Hungry Bay. It was not in the earlier collections of Jones and Goode, nor was it taken by us, in 1898 and 1901. It is not in the later collections that I have examined.

Its range extends from New Jersey to Florida, and through the West Indies to Bahia, Brazil. S. Carolina (Stimpson) ; Sarasota Bay, Fla., (Kingsley); Bahia (R. Rathbun). New York to Brazil (Rankin; M. J. Rathbun). St. Augustine and Cedar Key, Fla. (Yale Mus.).

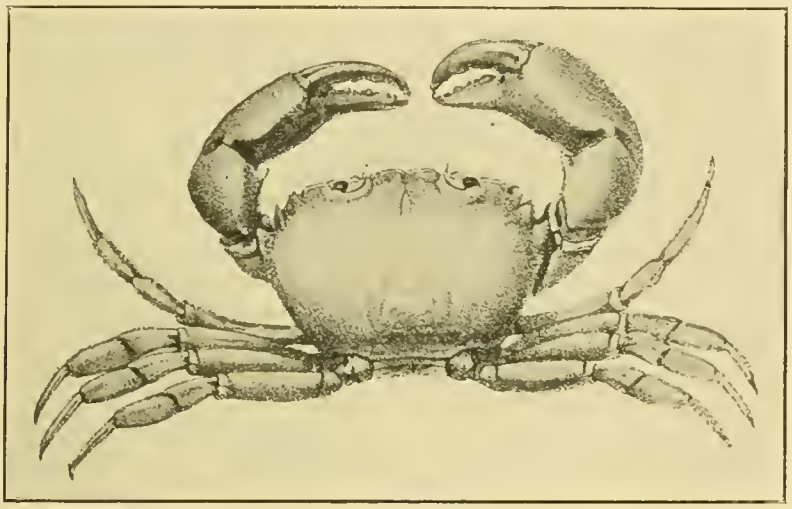

Figure 19.—*Eurytium limosum*, nat. size. After A. M.-Edw.

Lobopilumnus Agassizii (Stimp.) A. M.-Edw.

Pilumnus Agassizii Stimpson, Bull. Mus. Comp. Zool., ii, p. 142, 1870.

Lobopilumnus pulchellus A. M.-Edw., Exped. Miss. Sci. Mex., p. 299, pl. lii, fig. 5, 1880 (t. M. J. R.).

Lobopilumnus Agassizii M. J. Rathbun, Bull. Labr. Nat. Hist. Univ. Iowa, iv, p. 269, 1898; Amer. Naturalist, xxxiv, p. 139, 1900. Rankin, Crust. Bermuda I., p. 529.

Plate XIV, Figures 1, 2 (Variety).

The typical form of this species is not common at the Bermudas. Some of our specimens, taken in 1898 and 1901, appear to belong to it.

According to Miss Rathbun (op. cit., p. 269), the form described and figured by A. M.-Edw., in 1880, as *L. pulchellus* is the typical form of *L. Agassizii*, while his *L. Agassizii* is the peculiar variety (*bermudensis*). The latter is the prevailing form at the Bermudas.

The types of Stimpson were from off the Tortugas, in 5 to 13 fathoms.

Lobopilumnus Agassizii (Stimp.), var. **bermudensis** Rathbun.

Lobopilumnus Agassizii A. M.-Edw., Miss. Sci. Mex., v, p. 298, pl. lii, figs. 4–4*c*, 1880 (t. Miss Rathbun). Rankin, op. cit., p. 529, 1900

Lobopilumnus Agassizii, var. *bermudensis* M. J. Rathbun, Bull. Labr. Nat. Hist. Univ. Iowa, iv, p. 268, 1898.

Plate XIV, Figures 1, 2.

This crab is easily recognized by its rough hairy carapace, sharp, divergent, marginal teeth, denticulated frontal lobes, and the thickly tuberculated chelæ. The larger granules, which occur in clusters on the dorsal eminences, around the bases of the marginal spines, and on the front, bear long hairs, while a thick close coating of short hairs covers the intervening spaces. When cleaned, the general color of fresh specimens is yellowish or salmon; the fingers are black.

When living the carapace and legs are often rather thickly covered, and sometimes almost concealed, by a coating of whitish calcareous mud and sand that adheres to the hairs that cover the back. This is evidently a good protection against its enemies. Some of our specimens, taken in April and May, carried eggs (Nos. 3123, 4010, 4011).

Measurements of Bermuda specimens.

No.	Sex	Carapace length	Carapace breadth	Front between orbits	Chelæ length	Chelæ height
4010	♀ eggs	15	21	9.5	r. 14	9
					l. 12	7
4011	♀ eggs	18	24	10	l. 15	9
3123*	♀ eggs	18.5	26	11	r. 17	11
3167	♂ dry	23	32	12	r. 26	17
					l. 23	13
3136	♂ dry	16	22	9	15.5	9
3031†	♀ dry, fig.	20	27	11	l. 19	11
4088	♂	25	34	--	r. 27	18
					l. 24	14
1903	♂	23	29	12	20	11.5

* This is the specimen figured on pl. xiv, fig. 2.

† This is the original of pl. xiv, fig. 1.

It is most frequently found under stones and dead corals. One specimen was taken from the base of a gorgonian (*Verrucella grandis*), brought up from over 100 feet of water, outside the reefs (No. 4012). Common, both on the reefs and rocky shores, at low-tide.

It was in the early collections of J. M. Jones and G. B. Goode, in the Yale Museum. Florida and Bermuda (A. M.-Edw., from coll. Yale Mus.). Bermuda (Miss Rathbun). It is also in the 1905 collection of the Field Mus. Nat. History, and in that of Prof. T. Kincaid, 1903.

Pilumnus spinipes (A. M.-Edw.) Rathbun.

Micropanope spinipes A. M.-Edw., Miss. Sci., Mexico, v, i, p. 326, pl. liv, figs. 3–3*c*, 1880. (Abrolhos Is., Brazil, 30 fath.).

Pilumnus spinipes Rathbun, Bull. Labr. Nat. Hist. Univ. Iowa, iv, p. 264, 1898. Verrill, these Trans., vol. v, p. 577 (Bermuda).

FIGURE 20. PLATE XXVI, FIGURE 1.

A male (No. 3119, Yale Mus., pl. xxvi, fig. 1) and a female of this rare species were taken by our party in 1898. They have been studied by Miss M. J. Rathbun, who furnished the following notes on them: "The ♂ is 7.2^{mm} long and 10.2^{mm} wide. The outer face of the hands in the male is almost entirely smooth, as in the ♀, only the upper and proximal portion being spinulous; the outer and upper surface of the wrists is entirely covered with spinules or sharp granules. The upper surface of the carapace is rough with scaly granules, which, on the hepatic region, are developed into sharper and higher projections. The lobes of the front slope backward a little from the middle, where they are separated by a V-shaped notch; the margins of the lobes are nearly straight, and the little tooth next the orbit is scarcely separated from the rest of the margin. The outer orbital tooth and the next antero-lateral tooth are very small, but plainly marked and acute; below and between them there is a sharp subhepatic tubercle; the last three antero-lateral projections are sharp subequal spines. The ambulatory legs are very slender."

To these characters it may be added that the front is strongly bent downward, and there is a narrow transverse ridge at the bend, nearly parallel with the edge; the upper margins of the orbits are minutely denticulate; the sharp granules of the carapace and chelæ bear hairs, while many much finer hairs arise between them; the legs are covered above with long slender hairs; their merus joints have a row of small sharp spines along the front edge; the carpal joint of the chelipeds has a distal transverse groove, and two sharp spines on the anterior edge; the manus of the smaller chela has a slight dorsal groove bordered by rows of sharp granules; the dactylus has two distinct dorsal grooves, and the thumb one on each side, below. On the larger chela, which is much stouter, the grooves are

less evident. The large chela, in the specimen described (No. 3119), is 9.5^{mm} long; 4^{mm} high.

The color of the male, after being a short time in formalin, was pale buff on the upper side of the carapace and legs; chelæ yellowish or salmon on the palm, with a white patch preceded by a yellow one at the base of the claws, which were umber-brown.

The figure given by M.-Edwards, from which our fig. 20 was copied, is not very exact. The lateral teeth are too large and the two small post-ocular ones are omitted. The carapace, also, is more swollen laterally and wider posteriorly than in our specimens, so that the proportions are different.

Our two specimens are the only ones known from Bermuda. It occurs in the West Indies and as far south as the Abrolhos Reefs, Brazil (Edwards).

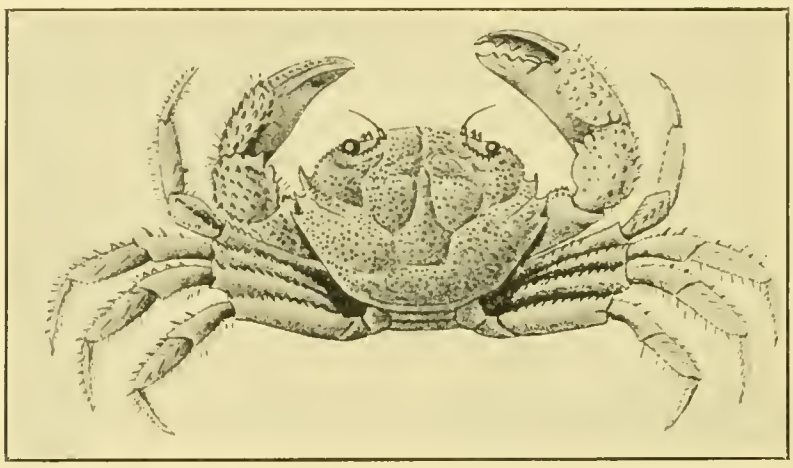

Figure 20.—*Pilumnus spinipes*, ♀, ×2½ times. After A. M.-Edw.

Eriphia gonagra Edwards.

Cancer gonagra Fabricius, Suppl. Ent. syst., p. 337, 1798.

Eriphia gonagra M.-Edwards, Hist. nat. Crust., i, p. 426, pl. xvi, figs. 16, 17, 1834; Ann. Sci. nat., 3, xvi, pl. 8, fig. 10, 1851. Gibbes, op. cit., p. 177. Dana, U. S. Expl. Exped. Crust., p. 250. Stimpson, Annals Lyc. Nat. Hist., New York, vol. vii, p. 217. Heller, Reise Fregatte Novara, p. 24, 1865. Smith, Crustacea of Brazil, these Trans., ii, p. 7, 1869 (measurements). Kingsley, Proc. Acad. Nat. Sci. Philad., for 1878, p. 397. A. M.-Edw., Miss. Sci. Mex., v, p. 238, pl. lvi, figs. 4–4*b*. Miers, Voy. Chall., xvii, p. 163. Rankin, op. cit., p. 527. M. J. Rathbun, Proc. Wash. Acad. Sci., ii, p. 141, 1900 (descr. colors); Brach. and Macr. Porto Rico, p. 42, 1901 (descr.).

Plate XIV, Figure 3.

This species is easily recognized by the regularly and strongly tuberculated chelæ, while the central part of the back of the cara-

pace is nearly smooth, and in life is gayly colored, but the colors are variable. Some of our specimens were colored as follows: "Carapace mottled with green and pink on a gray ground color. Chelæ nearly white, with the round tubercles of the upper side dark green, becoming yellow; dactyl and end of thumb chocolate-brown; ambulatory legs yellow, conspicuously banded with reddish brown, each band formed by numerous minute, red-brown spots. Under surfaces white (C. S. V.). These gay colors appear to be protective when in its natural environment, among bright colored sponges, algæ, etc., on the reefs.

The ratio of length to breadth of the carapace varies from 1:4 to 1:5.

Measurements of Bermuda specimens.

No.	Sex	Carapace length	Carapace breadth	Front between orbits	Chelæ length	Chelæ height
89*a*	♂	25	35	18	r. 28 l. 12.5	r. 15 l. 11
89*b*	♂	24.5	34	18	28	15
89*c*	♀ eggs	23	32	17	24	14
4009	♀ fig.	14	21	10.5	r. 19 l. 12	9 7
1903	♂	18.5	26	14	r. 20 5	11.5

Nos. 89*a*–89*c* were collected in the autumn of 1905, at Nonesuch I., by the Field N. H. Mus. expedition. No. 89*c* carried a large mass of eggs. No. 4009 is the figured specimen.

It lives mostly under large loose stones and dead masses of corals, both on the reefs and on the rocky shores. Several good specimens were taken by our Yale parties, both in 1898 and 1901. It had previously been taken by Mr. Goode, Mr. J. M. Jones, and others. It was also in the 1903 collections of the Biological Station and of Prof. Kincaid.

Rankin reported two specimens with ova taken in the summer of 1897.

It has a wide range, from S. Carolina and the Florida Keys to Rio, Brazil (Smith); Abrolhos Reefs, Brazil (Smith). Bahamas (Rankin); Porto Rico (Rathbun); S. Carolina (Rankin); Indian Key, Fla. (Yale Mus.). Pernambuco and Maceio, Brazil (Rathbun); Rio Janeiro (Dana; Heller); Colon (Yale Mus.).

Domecia hispida Eyd. and Soul.

Domecia hispida Eydoux and Souleyet, Voy. Bonite, i, Crust., p. 325, 1842, Atlas, pl. ii, figs. 5–10. Dana, U. S. Expl. Exped., Crust., p. 251, 1852. Stimpson, Annals Lyc. Nat. Hist. N. York, vii, p. 218 [90], 1860; Bull. Mus. Comp. Zool., ii, p. 145. A. M.-Edw., Miss. Sci. Mexico, Crust., p. 345, pl. lviii, figs. 2–2*d*, 1880. M. J. Rathbun, Bull. Labr. Nat. Hist. Univ. Iowa, iv, p. 276, 1898; Branner-Agassiz Exped. Brazil, p. 141, 1900; Brach. and Anomura, Porto Rico, p. 43, 1901.

Eupilumnus Websteri Kingsley, Proc. Acad. Nat. Sci. Philad., for 1879, p. 383 (descr. of young, Florida, t. M. J. R.). Generic name was preoccupied.

FIGURE 21.

This is a very small species, covered above with pale hairs. Length of carapace about 6.6^{mm}; breadth, 9.50. The color in life is light yellowish red, with the spines blackish; front darker.

It appears to be very rare in Bermuda. It lives between branches of corals and in holes in dead corals and stones. One small specimen, taken at Bermuda, was identified by Miss Rathbun.

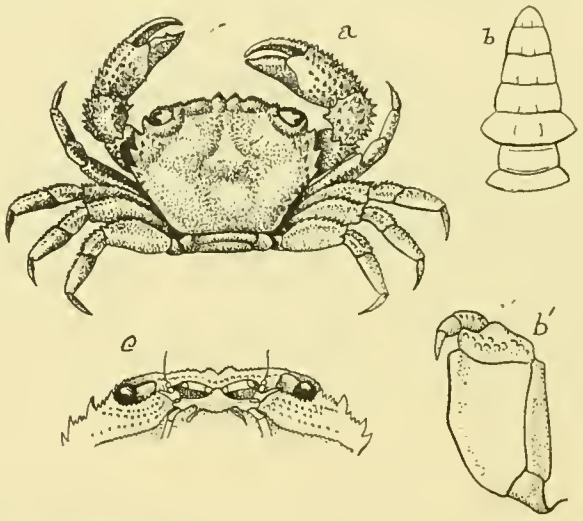

Figure 21.—*Domecia hispida*, male, enlarged; *b*, abdomen of male; *c*, front and antennal area; *b'*, outer maxilliped. After A. M.-Edwards.

It is very widely distributed in all tropical seas. Florida to Brazil; Hawaiian Is.; East Indies; Indian Ocean; Senegal; Cape Verde Is.; Maceio and Pernambuco, Brazil (Rathbun); Florida and Cuba (Stimpson). Gulf of California and Panama, between branches of *Pocillopora* (Yale Mus.).

Family, **PORTUNIDÆ** Leach, 1819. Swimming Crabs.

Of this extensive family, only twelve species have been collected hitherto at the Bermudas, and of these four* have not been previ-

* Namely: *Callinectes marginatus*, *C. Danæ*, *Acheloüs Smithii*, and *Charybdella lumidula*.

ously recorded. No doubt others can be obtained by using small-meshed seines in the shallow bays, and by the use of trawl-nets in deeper water.

We should naturally expect to find there *Charybdella rubra*, *Arenæus cribrarius*, *Achelous spinicarpus*, and *Achelous sulcatus*, all of which are found at least as far north as the Georgia and Carolina coasts, and part of them as far north as Cape Hatteras.

Analytical Table of the Bermuda Genera.

A.—Abdomen of male T-shaped; carapace wide, thick, and strong; marginal teeth 8, besides outer orbital, all except last subequal; 8th stout and sharp ..... *Callinectes*

A'.—Abdomen of male not T-shaped; carapace weaker, less thick; chelæ slender, prismatic.

B.—Marginal teeth 8, subequal, except last, which is generally longer or stouter; flagellum of antennæ included in the orbit, the antennal notch wide.

C.—Carapace convex, nearly smooth, glossy; ambulatory legs remiform and fringed; swimming legs without longitudinal ribs and grooves on merus and carpus; merus of maxillipeds not prolonged ..... *Portunus*

C'.—Carapace more depressed, usually with granulated transverse ridges, and covered with short scale-like hairs; ambulatory legs tapered, not evidently remiform; swimming legs flat, strengthened with longitudinal ribs and hairy grooves on most or all the segments except basal, which is transversely grooved; merus flat; merus of maxillipeds prolonged beyond insertion of flagellum ..... *Acheloüs*

B'.—Marginal teeth 8, alternately larger and smaller; last one not much elongated; flagellum of antennæ wholly or partly excluded from orbit; antennal notch of orbit narrow ..... *Charybdella*

Callinectes Ordway, 1863.

This genus embraces a considerable number of species of large, very active, predaceous swimming crabs, most of which are American, but a few occur on the West coast of Africa. They occur on both coasts of America, in the temperate and tropical zones. Nearly all the species are valued as food.

The common "blue crab" or "edible crab" of the eastern coast of the United States (*C. sapidus*, formerly *C. diacanthus*) is the type. The species resemble each other pretty closely, and can best be distinguished, in doubtful cases, by the form and length of the male generative appendages, as was first pointed out by Ordway, in his monograph of the genus.

Four species have been taken at the Bermudas, but only one (*C. ornatus*) is common. Other species, especially *C. tumidus*, may be expected to occur, when the fauna becomes more fully known.

Analytical Table of the Bermuda species of Callinectes.

A.—Frontal teeth four, not counting inner orbitals.

B.—Intramedial gastric area broad and short: ratio of length to breadth about 1:3; male appendages not very short; tips crossed ..... *ornatus*

B′.—Intramedial area longer and less broad; length to breadth about 1:2.

C.—Male appendages very short, scarcely exceeding 3d abdominal segment. *marginatus*

C′.—Male appendages much exceeding 3d abdominal segment; tips straight, not crossed ..... *Dance*

A′.—Frontal teeth two, not counting the inner orbitals; male appendages very long, about reaching end of abdomen, tips divergent ..... *sapidus*

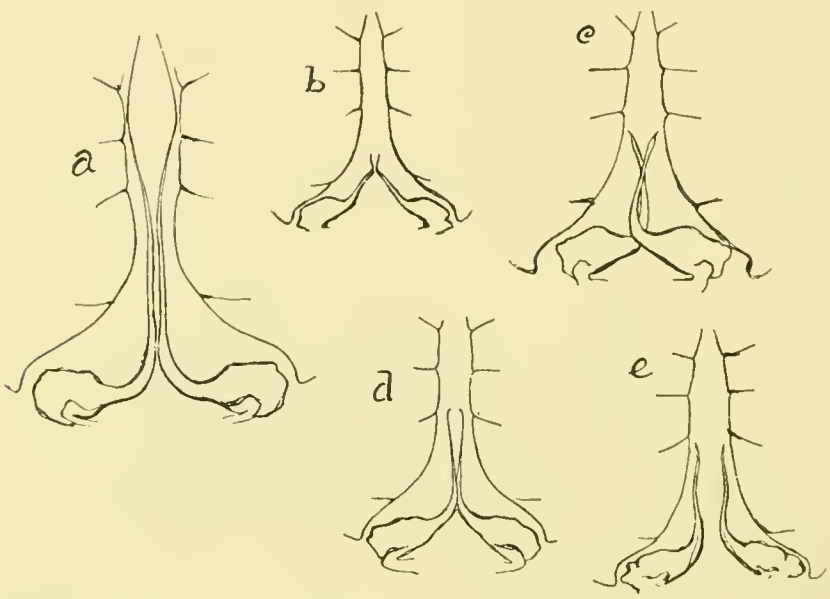

Figure 22.—Male generative appendages (verges) of *Callinectes*: *a*, of *E. sapidus*; *b*, of *C. marginatus*; *c*, of *C. ornatus*; *d*, of *C. Dance*; *e*, of *C. tumidus*. All these are West Indian species. After M. J. Rathbun.

Callinectes ornatus Ordway. *Edible Crab.*

Callinectus ornatus Ordway, Boston Journ. Nat. Hist., vol. vii, p. 571, 1863. Smith, Crust. Brazil, these Trans., ii, p. 8, 1869 (descr.). A. M.-Edw., Miss. Sci. Mex., v, p. 225, 1879 (as var. of *diacanthus*). Smith, Annual Rep. U. S. Fish Comm., for 1885, p. 29, 1886. Rankin, Annals N. York Acad. Sci., xii, p. 529. Rathbun, The Genus Callinectes, Proc. U. S. Nat. Mus., xviii, p. 356, pl. xv (general); pl. xxiv, fig. 3, pl. xxv, fig. 2, pl. xxvi, fig. 2, pl. xxvii, fig. 2 (details), 1896; vol. xxi, p. 596; Brach. and Macr. Porto Rico, p. 48, 1901 (descr.); Amer. Naturalist, xxxiv, p. 140.

Figures 22*c*, 23*b*. Plate XVII, Figure 1. Plate XXI, Figure 2.

This species can easily be distinguished from most of the others of this genus by the four prominent, frontal teeth; those of the antero-lateral margins are rather long, nearly straight and acute. The ambulatory legs are long and slender. The carapace is convex.

The colors of the adults, especially of the males, are often handsome, but are variable. Frequently the carapace is dull olive or olive-brown, usually with a large, ill-defined, roundish spot of orange or orange-red on each side posteriorly ; the lateral spines and denticles light blue or whitish; eye-stalks purple. Chelipeds proximally similar to carapace, with the spines pale blue and joints red, with blue spots ; inner surface of palm of chela with a large bright blue patch, bordered with purple ; digits mostly purple, tipped with red. Ambulatory legs bright blue above, with a band of scarlet at each joint and a patch of paler blue or green on the posterior and lower side of each segment ; tarsi red. Swimming legs similar in color, but with the red articular bands wider; a patch of yellow or orange on each segment; terminal segment bright scarlet on the distal half, separated from the blue proximal portion by a band of orange. Abdomen posteriorly light blue.

23 24

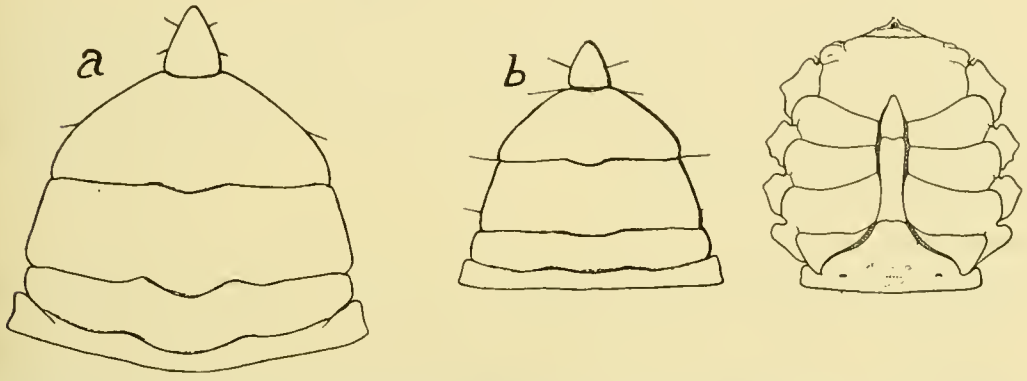

Figure 23.—Abdomens of female *Callinectes ; a*, of *C. sapidus ; b*, of *C. ornatus.*
Figure 24.—Abdomen of a male *Callinectes sapidus*, ⅔ nat. size.

Many specimens are much less brilliantly colored. Some are mottled with lighter and darker olive on the carapace. The young are usually rather dull or plain olive-yellow; some are light olive or greenish above. Albino specimens often occur in which the entire carapace and legs are pale gray or nearly white, or in which white is the prevailing color.

One large dark male had the carapace, above, dull dark brown, the long postero-lateral spines, as well as the others, with white tips. Chelæ purplish brown, above; inner lateral and lower surfaces white, except inner surfaces of finger and thumb, which were deep purple. Ambulatory legs dark blue and brown both above and below, with whitish bands at the joints beneath. Swimming legs dark bluish brown, with a central yellowish white patch on outside of each segment, except the last, which is bright brownish red.

Measurements of Bermuda specimens.

No.	Sex	Carapace l'gth	Carapace br'dth total	Carapace br'dth spines	Front bet. orbits	Chelæ l'gth	Chelæ h'ght	Central gastric area l'gth	Central gastric area br'dth
4041	♀	39	73	63	13	r. 39	14	--	--
4039*a*	♂	50	101	85	17	r. 59 l. 52	18 14	7.5	21
4039*b*	♂	47	99	83	17	r. 59	16	7	21
4039*c*	♂	42	92	75	15	r. 53 l. 55	13.5 15	6	18.5
4039*d*	♂	35	75	59	13	r. 38.5	12	5	15
158 F	♂	14	31.5	23.5	6	13	4		

We found this species very common at Bermuda in the shallow water of inlets and bays, especially at Hungry Bay, in March and April, 1901. Also at Castle Harbor, Long Bird I., etc. It was contained in the earlier collections of J. M. Jones, G. B. Goode, and others. In the 1905 collection of the Field Nat. Hist. Museum, there are many fine specimens from St. Davids I., Hermit Bay, etc. One of the latter, only 13.5^{mm} long, carried eggs.

Its range extends from Cape Hatteras to Brazil. Off C. Hatteras, 14 fath. Abrolhos Reefs and Caravellas, Brazil (Smith); S. Carolina (Ordway); St. Catharine, Brazil (M.-Edw.). Florida (Stimpson). Victoria, Brazil (Rathbun).

Callinectes marginatus (M.-Edw.), var. **larvatus** (Ord.). *Edible Crab.*

Neptunus marginatus A. Milne-Edw., Nouv Arch. Mus. Hist. Nat. Paris, x, p. 318, pl. xxx, fig. 2, 1861* (*t.* M. J. Rathbun)..

Callinectes larvatus Ordway, Jour. Boston Nat. Hist. Soc., vii. p. 573, 1863. Smith, these Trans., ii, p. 9, 1869 (Brazil). M. J. Rathbun, The Genus Callinectes, Proc. Nat. Mus., xviii, p. 358, pl. xvii, xxiv, f. 5, xxv, f. 4, xxvi, f. 4, xxvii, f. 4, 1895. Rankin, Crust. from Bahamas, Annals N. Y. Acad. Sci., xi, p. 232, 1898.

Callinectes marginatus M. J. Rathbun, Proc. Biol. Soc. Wash., xi, p. 149, 1897 ; Proc. Wash. Acad. Sci., ii, p. 142, 1900. Brach. and Macr. Porto Rico, p. 48, 1901.

Figure 22*b*. Plate XVIII, Figure 1.

This is closely allied to *C. Danæ*, of the West Indies and Brazil. The latter has straighter and more equilateral marginal teeth and the male generative appendages are longer and different in form.

It also closely resembles *C. ornatus* in most respects. It can best be distinguished by the longer and narrower intramedial gastric area of the carapace, which is only about twice as broad as long. The

* This species was based on a small sterile female (figured as a male) from W. Africa. Prof. S. I. Smith first referred it to *Callinectes*, with some doubt, in 1869.

marginal teeth and frontal lobes are very similar to those of *C. ornatus*, but in this the two middle frontal lobes are a little more prominent. The basal appendages of the male abdomen are unusually short and small, and quite unlike those of the other species. (See fig. 22, *b*.) Its colors in life were not noted.

Measurements.

No.	Sex	Carapace l'gth	Carapace breadth total	Carapace breadth —spines	Front bet. orbits	Chelæ length	Chelæ height	Locality
1735	♂	42	90	77	16	r. 58 l. 55	r. 20 l. 16	Key West, Fla.
1903*b* fig.	♂	20	41	34	7	r. 21	6.5	Bermuda
1427	♂	47	99	84	28	r. 66 l. 64	23 18	Florida

On No. 1735, the intramedial gastric area is 7.5^{mm} long in middle; 16^{mm} broad anteriorly, In 1903*b*, it is 3.75^{mm} by 8^{mm}; in 1427, it is 8^{mm} long, by 20 broad at widest part anteriorly.

A rather large specimen was in the collection of Mr. Goode (1876). Several young were obtained in the summer of 1903 by the Bermuda Biological Station. It ranges from Florida to Bahia, Brazil (Smith). It is common and used as food in some of the West Indies. Dominica I., common (A. H. Verrill, 1906). On the west coast of Africa, from Cape Verde Islands to St. Paul de Loanda (Rathbun). Pernambuco, Maceio, etc., Brazil (Rathbun). Ordway's types of *C. larvatus* were from Florida, Bahamas, and Hayti.

The type of *N. marginatus* (Edw.) was from West Africa. It was a barren or immature female with no very evident characters, as figured, to identify it with this species. This determination was made by Miss Rathbun.*

* I am not convinced of the correctness of this determination. The latter, as described and figured, has a broader carapace; ratio, as described, 1:2.17, as figured, 1:2.33, while in our *C. larvatus*, of similar size, it is 1:2.05; the merus of the maxillipeds has a decided notch at the insertion of the palpus, to which Edwards particularly refers; in *larvatus* the notch is not evident. The transverse granulated ridge of the carapace, from the anterior base of the lateral spines, curves much farther forward than in *C. larvatus*. It seems to me more probable that *marginatus* is a distinct but closely allied African species.

However Miss Rathbun has recorded additional specimens of *C. marginatus* from several localities on the W. African coast and Cape Verde Islands (op. cit., p. 291, 1900), but she has neither figured nor described the African specimens. Meantime, I prefer to retain *larvatus* as a name for the American form.

Callinectes Danæ Smith.

Lupa diacantha Dana, Crust. U. S. Expl. Exped. i, p. 272, 1852, Atlas, pl. xvi, fig. 7, 1855.

Callinectes diacanthus Ordway, op. cit., p. 575, 1863 (*non* Latr. sp.).

Callinectes Danæ Smith, these Trans., ii, p. 7, 1869 (measurements). M. J. Rathbun, The Genus Callinectes, Proc. U. S. Nat. Mus., xviii, p. 357, pl. xvi, pl. xxiv, fig. 4, xxv, fig. 3, xxvi, fig. 3, xxvii, fig. 3, 1895 (descr.); Brach. and Macrura, Porto Rico, p. 4, 1901 (descr).

FIGURE 22, *d*.

The carapace of this species closely resembles that of *C. marginatus*, but the male is easily distinguished by the form of the male verges (see fig. 22, *d*). The female abdomen is narrower than in the other species. The carapace is rather strongly granulated. The five antero-marginal teeth, following the orbital, are all similar, broad at base, with sharp acuminate tips, their two edges nearly equal, and scarcely bent forward, granulated and hairy on the bases; the two succeeding teeth are still more acute and more squarrose; the last tooth is more than three times the length of the preceding. The front has four lobes, the two inner much smaller than the others, obtuse; the outer ones prominent, subacute; preorbital tooth about equal in size and more acute.

The length to breadth of the carapace varies from 1:2.08 to 1:2.26, Our Bermuda specimen has the carapace 32^{mm} long; 66^{mm} wide (total); 53^{mm} wide without spines.

The only Bermuda specimen examined was a male collected long ago by J. M. Jones (coll. Yale Mus.). Its range is from Florida to Rio, Brazil. Pernambuco and Bahia, Brazil (Smith); Rio Janeiro (Dana). Porto Rico (Rathbun).

Callinectes sapidus Rathbun. *Blue Crab; Edible Crab* of the northern United States.

Portunus hastatus (*pars*) Fabr., Supl. Ent. Syst., p. 367.

Portunus diacanthus (*pars*) Latr., Encycl. Meth., x, p. 190, 1825.

Lupa hastata Say, Journ. Acad, Nat. Sci. Phila., i, p. 65, 1818. Desm. Consid. Gen. Crust., p. 98.

Lupa diacantha (*pars*) H. M.-Edw., Hist. nat. Crust. i, p. 451, 1835; Dekay Zoöl. N. York, Crust., p. 10, pl. iii, fig. 2 (*non* Dana).

Neptunus diacanthus (*pars*) A. M.-Edw., Nouv. Arch. Mus. N. Hist., x, p. 316, pl. xxx, fig. 1–1*c*, 1861.

Callinectes diacanthus (*pars*), var. *hastatus* A. M.-Edw., Miss. Sci. Mex., v, pp. 223, 224, 1879.

Callinectes sapidus M. J. Rathbun, The Genus Callinectes, Proc. U. S. Nat. Mus., xviii, p. 352, pl. xii, pl. xxiv, fig. 1, pl. xxv, fig. 1, pl. xxvi, fig. 1, pl. xvii, fig. 1 (details), pp. 368–373 (habits), 1896; Amer. Naturalist, xxxiv, p. 140, fig. 3, 1900.

W. P. Hay, The Life History of the Blue Crab (*Callinectes sapidus*). Appendix to Annual Report of the Com. of Fisheries for 1904, pp. 397–413, 4 plates, 1905 (habits: moulting, breeding, etc.).

Callinectes hastatus Ordway, op. cit., p. 568. S. I. Smith, these Trans., vol. v, p. 33; Report Invert. Vineyard Sound, etc., p. 548. Verrill, Rep. Invert. Vineyard Sound, pp. 367, 468, 1873 (habits). R. Rathbun, Fisheries and Fishery Industries of the U. States, Crustacea, Part V, sec. i, pp. 775–778, pl. 267 (habits and statistics), 1884; sect. v, vol. ii, pp. 629–648, 1887.

Paulmier, F. C., Higher Crustacea of New York City, New York State Museum, Bulletin 91, Zoölogy 12, p. 142, fig. 11, 1905.

FIGURES 22*a*, 23*a*, 24. PLATE XVII, FIGURE 2.

In this species the adult males are handsomely marked by bright blue on the chelipeds, legs, and margins of the carapace, the greater part of the dorsal surface of the carapace being green. In the adult female a dull red usually takes the place of the blue of the male.

According to observations first made on this crab by Professor Louis Agassiz, about 1860, it has interesting courting habits.*

Probably the bright blue ornamentation of the male is due to sexual selection, for the male, during his courtship, stands on the tips of his legs, and "dances" or struts in front of the female, with his claws outspread to display his charms. The rival males, also, are belligerent at such times.

An account of the courting and pairing habits was quoted by Miss Rathbun (The Genus Callinectes, p. 369) from a long letter on the habits of this crab by Hon. John D. Mitchell, of Victoria, Texas, which agrees closely with the account by Agassiz.

He states that the sexually mature females are in their third summer. Meeting one of these, the adult male "will elevate himself on the tips of his legs, getting as high from the ground as possible, extend his claws to their widest extent, supporting himself with his paddles, and in this position he will strut slowly and pompously in front of her. Should another male appear, a battle ensues. The sexual act lasts from three to six hours."

* Professor Agassiz then described in detail these phenomena and other habits of this crab to me and several of my classmates, his special students. He stated that they were new observations that he had just made on the south coast of New England, and in which he was then very much interested. I wrote out his observations in a diary that I kept at that time and preserved for many years. I am not aware that he ever published these observations.

According to Prof. W. P. Hay (op. cit., p. 405) the male takes possession of the young female, shortly before she is to moult into the adult condition, and carries her around with him until she is ready to moult, when he places her in a safe retreat and stands guard over her during the moulting. As soon as this is accomplished he immediately copulates with her and carries her away, remaining with her for "a day or two" or until her shell hardens.

That large numbers of males are taken in spring, each carrying a female with him (called "doublers" by the fishermen), is well known. But it is probable that only a part pair in this way, and that both accounts are correct.

Professor Hay thinks the females neither pair nor produce eggs but once, dying soon afterwards. This belief rests on very insufficient evidence. Most of the larger species of crabs are found carrying eggs at various stages of growth, and females of this crab, of at least two different sizes, are often found with eggs. In dissecting large numbers, during many years of instruction of students in my zoölogical laboratory, we have found large numbers of large size, and apparently more than three years old, containing fully developed ova, in early spring, indicating that the females breed at least twice, like the males. Perhaps these older females are the ones before whom the males perform their courtship dances. This matter needs much more careful investigation, under very favorable conditions, before it can be considered as settled.

This species and probably other allied crabs, can readily be put into a limp and helpless condition, apparently like the hypnotic state of man, by gently and continuously rubbing the carapace, over the region of the heart, in a particular way. I have often made the most pugnacious and active adult males perfectly docile in this way in a few minutes, and if the treatment be carried further, they soon become limp and helpless, as if dead, remaining where placed for some time. They soon spontaneously recover their activity, if left to themselves. I have often done this, as long ago as 1870.

This performance is generally a great surprise even to the fishermen who have handled crabs all their lives, for it does not seem to be generally known.

Our largest specimen (No. 1712, var. *acutidens* ♂) is from Nassau, N. P. Length of carapace, 185^{mm}; total breadth, 204^{mm}; less spines, 152^{mm}; between orbits, 25^{mm}; length of larger (left) chela, 116^{mm}; its height, 32^{mm}. The lateral teeth are very acute.

This species appears to be very rare, if not accidental, at Bermuda. It has been recorded by Miss Rathbun as in the Mus. Comp.

Zoölogy, from the collection of A. S. Bickmore, made about 1862. We were unable to find it or learn of its presence there, nor has it occurred in any of the other Bermuda collections that I have seen.* It is the common edible crab of the Atlantic coast, abundant from Southern New England to Florida, Louisiana and Texas.

It ranges to Brazil.† Rio Grande (Miss Rathbun ; also in Yale Mus.). It often ascends estuaries to points where the water is very brackish. Very abundant in Chesapeake Bay, where it is fished on a great scale.

Portunus Fabr. and **Achelous** De Haän, 1833.

Some of the distinctions between *Portunus* (Fabr., 1798, as now restricted) and *Acheloüs* (type *A. spinimanus*) are neither very definite nor constant. The species intergrade in some of the characters. In respect to the form of the carapace, which in typical *Portunus* is more broadly arched, "the center of the arc near the posterior end," the proportions change greatly with the growth. Young specimens of some species would thus fall in one group (*Acheloüs*) and the broader adults in the other. *A. anceps*, of the sizes usually taken, is nearly intermediate in form, if the long lateral spines be not reckoned in the measurements, but it lacks the flat remiform front legs of *Sayi*.

In *P. Sayi*, however, we see a distinctly remiform character of the anterior two pairs of ambulatory legs. They have the basal joint and merus smooth and nearly terete, while the three terminal segments are much flattened and strongly fringed with hairs on the edge, thus adapting them specially for swimming. This would seem to be a true generic character, for in the species of typical *Acheloüs* the distal segments of the legs are tapered and grooved, with the dactylus slender and sharp, and therefore adapted for walking.

To this may be added the character of the merus of the outer maxillipeds, which in *Acheloüs* is prolonged beyond the insertion of the palpus and is angular outwardly, while in *P. Sayi* it is not pro-

* Mr. Witmer Stone, in Heilprin's "Bermuda Is.," p. 147, recorded two small males of "*Neptunus hastatus*." They may have been *Portunus Sayi* or *Callinectes ornatus*, but probably not this species.

Hurdis, Rough Notes and Mem., 1897, p. 361, gives *Lupa diacantha* as a Bermuda species in his brief list of Crustacea, but his names of the Crustacea are very unreliable. (See Bibliography, below.)

† Miss Rathbun (1896) established a variety or subspecies *acutidens* for a South American form, having sharper lateral teeth. This variety extends from the Bahamas to Rio Janeiro.

longed and is rounded distally. Hence I am disposed to consider the group including *P. Sayi* a distinct genus.

In these characters this species agrees with *P. pelagicus*, the type of the genus. I have compared it with a number of characteristic specimens of the latter from Japan. (Yale Mus., coll. E. S. Morse.)

Charybdella M. J. Rathbun, 1897 = *Cronius* Stimpson, 1860 (name preoccupied).

This genus was established for *C. rubra*, as the only species. The latter, which is a common West Indian and Florida species, differs from our species of *Acheloüs* in several important characters. Its outer maxillipeds have the merus short; the manus of the chelipeds bears three distal spines; the antero-marginal teeth are alternately larger and smaller; the antennal sinus of the orbit is much contracted; the inner orbital tooth is deeply bilobed. But the *Charybdella tumidula*, referred later to the same genus by Miss Rathbun, would seem to go about as well in *Acheloüs*, where it had previously been placed, for its characters are partly intermediate between the two genera. In most respects it is very closely related to *A. Gibbesii*, which it closely resembles in the strong areolation of the carapace; the frontal denticles; and bilobed interorbitals; the distal denticulation of the merus of the swimming feet, etc. But owing mainly to the alternation of large and small marginal teeth, I have left it in *Charybdella*. The characters of the antennal sinus and antennæ are intermediate.

Some special diagnostic characters of the Bermuda species (and some others nearly allied) of Portunus, Acheloüs, and Charybdella.

1.—Carapace convex, nearly smooth, glossy, with feeble areolations and few hairs ..... *Sayi*

2.—Lateral marginal teeth alternately distinctly larger and smaller. *tumidula; rubra*

3.—Posterior corners of carapace distinctly angular ..... *spinicarpus*

4.—Posterior lateral marginal spine scarcely longer than the rest ..... *depressifrons*

5.—Inner orbital tooth bilobed, so that the front has eight teeth or lobes between the orbits, counting the inner orbitals. *tumidula; rubra; Smithii; Gibbesii* (bilobing feeble); *spinimanus*

6.—Carapace when fresh having a pair of well defined, round, ocellated, red spots on the flanks ..... *Sebæ*

7.—Carapace having a pair of ill defined red or brownish spots on the flanks. *tumidula*

8.—One or two round silvery spots on each side of carapace, near bases of marginal spines ..... *Gibbesii*

9.—Merus of chelipeds having five or six spines on the inner margin. *Gibbesii; rubra* (not always); *Sebæ; depressifrons; spinimanus* (sometimes).

10.—Posterior distal spine of merus of chelipeds obsolete or reduced to a tubercle ..... *tumidula ; depressifrons ; Sayi*

11.—Manus of chelipeds with two distal spines, one behind the other. *anceps ; (ventralis) ; sulcatus ; Sebæ*

12.—Manus with three distal spines, each on a different rib ..... *rubra*

13.—Manus with a brilliant silvery or iridescent area on the superior outer surface ..... *Ordwayi*

14.—Inner spine of carpus more than half as long as manus ..... *spinicarpus*

15.—Ambulatory legs long, oar-like, with the three distal segments wider, much flattened, and strongly fringed on the under margin ..... *Sayi*

16.—Swimming (posterior) leg with an erect acute spine on the basal joint. *Sebæ*

17.—Swimming legs having the posterior distal end of merus angular and armed with a sharp spine ..... *spinimanus* (spine small) ; *rubra ; Sebæ*

18.—The same, armed with a row of small, often unequal denticles. *spinimanus ; Smithii ; tumidula ; Gibbesii ; Ordwayi*

Analytical table of the Bermuda species of Portunus, Acheloüs, and Charybdella.

A. Frontal teeth six, counting the inner orbitals, which are not bilobed.

B. Anterior ambulatory legs remiform with the distal segments flat and strongly fringed ; merus not flat nor fringed. Carapace wide, with margin broadly arched in front ..... Genus *Portunus*

b. Carapace nearly smooth, glossy, not pubescent ..... *Sayi*

B′. Anterior legs adapted for walking, not distinctly remiform, nor much flattened distally ; dactylus slender. Carapace margin more narrowly arched anteriorly ; dorsal surface strongly areolated or sculptured, usually closely covered with short hairs ..... Genus *Acheloüs*

C. Posterior lateral tooth distinctly longer than those in front of it.

D. Basal joint of posterior legs with a sharp erect spine ; also a straight spine on outer distal angle of its merus. Four inner frontal spines prominent. A pair of round red spots on the flanks ..... *Sebæ*

D′. Basal joint of posterior legs without a spine ; no large spine on its merus.

E. Chelæ with a smooth, iridescent area on upper outer surface of manus ; a single distal spine on manus ; four inner frontal teeth prominent .. *Ordwayi*

E′. Chelæ without an iridescent area.

F. Chelæ with two distal spines on manus, one before the other ; posterior lateral tooth elongated, spiniform ..... *anceps*

C′. Posterior lateral tooth little or not at all larger than the others. Chelæ with a single distal spine on manus. Frontal teeth very short, middle two much smaller ..... *depressifrons*

A′. Frontal teeth eight, counting the inner orbitals, which are bilobed, each as two. Carapace sculptured, closely pubescent ; posterior lateral tooth moderately elongated ..... Genera *Acheloüs* (*pars*) and *Charybdella*

F. Antero-marginal teeth, except last, equal or nearly so.

G. Two interior frontal teeth decidedly more prominent than the others. *spinimanus*

G′. Two interior frontal teeth scarcely more prominent than the others .. *Smithii*

F′. Antero-marginal teeth unequal, alternately larger and smaller ... *C. tumidula*

Portunus Sayi (Gibbes) Rathbun.

Portunus pelagicus Bose, Hist. nat. des Crust., p. 219, pl. v, fig. 3, 1805.

Lupa pelagica Say, Jour. Acad. Nat. Sci. Philad., i, p. 97, 1817. DeKay, Nat. Hist. New York, Crust., p. 11, pl. vi, fig. 8, 1844 (*non* Linn, spec., *nec* Fabr.).

Lupa Sayi Gibbes, Proc. Amer. Assoc. Adv. Sci., 3d meeting. p. 178, 1850. Dana, U. S. Expl. Exped. Crust., p. 273, pl. xvi, fig. 8. 1852. Stimpson, Proc. Acad. Nat. Sci. Philad., 1858, p. 38.

Neptunus Sayi Stimpson, Ann. Lyc. Nat. Hist. New York, vii, p. 220 (92), 1860; Bulletin Mus. Comp. Zoöl., i, p. 147, 1870. A. Milne-Edw., Nouv. Arch. du Mus. d'Hist. Nat., x, p. 317, pl. xxix, figs. 2, 2*a*, 2*b*, 1861. Smith and Harger, Trans. Conn. Acad., iii, p. 26, 1874. Kingsley, Proc. Acad. Nat. Sci. Philad., 1878. p. 319, 1878; op. cit., for 1879, p. 398. A. M.-Edw., Miss. Sci. Mex.. v, p. 210, 1879. Smith, these Trans., v, p. 121, 1879.

Portunus Sayi M. J. Rathbun, Bull. Labr. Nat. Hist. Univ. Iowa, p. 276, 1898; Amer. Nat., xxxiv, p. 140, 1900.

? Neptunus hastatus W. Stone, in Heilprin's Berm. I., p. 147 (*non* Linné sp.).

Figure 25. Plate XVIII, Figure 1. Plate XXI, Figure 1.

This has the anterior ambulatory legs longer, and decidedly more flattened and fringed more strongly with long hairs on the distal

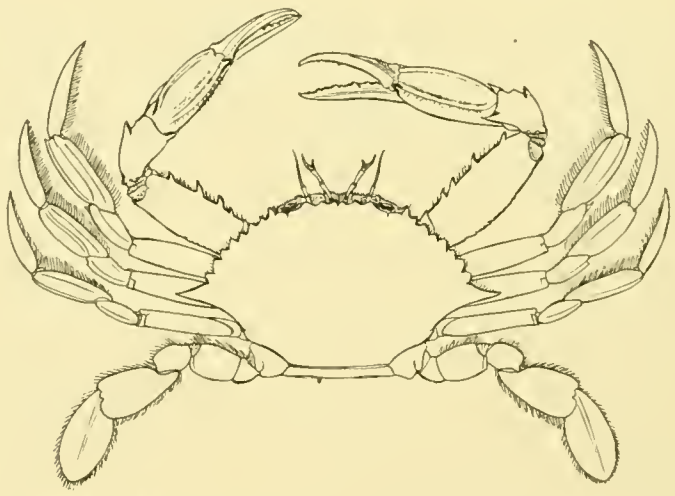

Figure 25.—*Portunus Sayi*, ½ nat. size. Drawing by J. H. Emerton, from nature.

joints than any other of our allied species, and its swimming legs are long and thick, in accordance with its more strictly oceanic habits. The merus and carpal joints of the swimming legs, also, are smooth, ovate, and thickened, and the basal joints are longer than usual. It is an active swimmer. The carapace is smoother than in the other Bermuda species. In addition to these characters, it has, as other diagnostic characters, four small, but nearly equally prominent and regular frontal teeth; the inner ones rather smaller and

narrower; the posterior lateral tooth is stout, thickened, excavate on the front edge; the other lateral teeth are regular, triangular, nearly equilateral, not much inclined forward.

The ratio of length to breadth of carapace, not including lateral spines, is about 1: 1.60.

The inner orbital tooth is usually simple, but in one case (4036*b*) it was bilobed on one side, entire on the other.

Measurements.

No.	Sex	Carapace l'gth	Carapace br'dth total	Carapace br'dth —spines	Front bet. orbits	Chalæ length	Chalæ height —spines	Locality
11074*a*	♀ eggs	30	61	48	11	r. 35.5 l. 34.0	9.5 8.5	Off Hatteras
11074*b*	♂	31	62	53	10	r. 46	10	Off Hatteras
4036 fig.	♂	22.5	44	36	9	31	7.0	Off N. Jersey
4036*b*	♀ eggs	23	46	38	10	27	7.5	Off N. Jersey
1903*a*	♀ eggs	17	34	21	8	r. 19	5.5	Bermuda
1903*b*	♂ juv.	14	26	21.5	5.5	17	4.0	Bermuda

No. 1903*a*, with few eggs, was taken by the Biological Station party in July, 1900. The specimen (No. 4036*b*), carrying eggs, was taken in July, 1883, by the "Albatross." No. 11074*a* was taken Sept. 21.

This is one of the numerous species of invertebrates that have acquired the habit of living normally among the masses of floating "gulf-weed" or *Sargassum*, etc., in mid-ocean, and especially along the course of the Gulf Stream. Like most of the other animals associated with it, this crab has colors imitative of the gulf-weed and the whitish patches of encrusting bryozoa (*Biflusta*), so common on the gulf-weed. The whitish patches of bryozoa look much like the pale patches on the back of the crab, while the olive-green and brown mottled colors of the latter are like those of the plants. It is, however, able to leave the gulf-weed and swim rapidly for some distance. Perhaps it does not come ashore at the Bermudas except when cast on the shores in masses of gulf-weed, etc. Most of those collected, if not all, have thus occurred. It is usually associated, in such cases, with *Planes minutus*, *Leander tenuicornis*, and other species having the same mode of life.

It was in the collection of Mr. Goode, 1876. We took it, in the same way, in 1898 and 1901. Young specimens were contained in the collections of the Bermuda Biological Station, obtained in the summer of 1903, associated with *Planes*.

It is often carried northward in the Gulf Stream to Cape Cod, St. Georges Bank, and even off Nova Scotia. Prof. Smith took it in

N. lat. 41° 30′, in *Sargassum*, 1872. Southward it is abundant along the Gulf Stream to Florida, Cuba, and the Gulf of Mexico. Few of the Bermuda specimens carried eggs; most are quite young.

Achelous anceps (Saus.) Stimpson.

Lupea anceps Saussure, Crust. Antilles, Mex., Mem. Soc. Phys. Hist. Nat., Genève, xiv, p. 434 [18], pl. ii, fig. 11–11*b*, 1858 (Cuba).

Neptunus anceps A. M.-Edw., Arch. Mus. Nat. Hist., x, p. 328, 1861; Miss. Sci. Mex., v, p. 213, 1879. Rankin, Ann. N. York Acad. Sci., xii, p. 530, 1900. S. I. Smith, Annual Rep. U. S. Fish Comm. for 1895, p. [30], 1886 (Cape Hatteras).

Lupa Duchassagni Desb. and Schramm, Crust. Guadeloupe, p. 39, pl. iv, fig. 25 (*t.* Stimpson).

Portunus (*Achelous*) *anceps* (*pars*) M. J. Rathbun,* Amer. Naturalist, vol. xxxiv, p. 140.

Neptunus ventralis A. M.-Edw., Exp. Sci. Mex., v, pl. xi, fig. 3, 1879. Rathbun, Brach. and Macr. Porto Rico, p. 45.

Acheloüs anceps Stimpson, Ann. Lyc. Nat. Hist. N. York, p. 113, 1871.

Figure 26. Plate XX, Figures 1, 2. Plate XXVII, Figure 4.

This species is easily recognizable by the long, sharp, posterior lateral spines; the four very short, obtuse, unequal frontal teeth; and

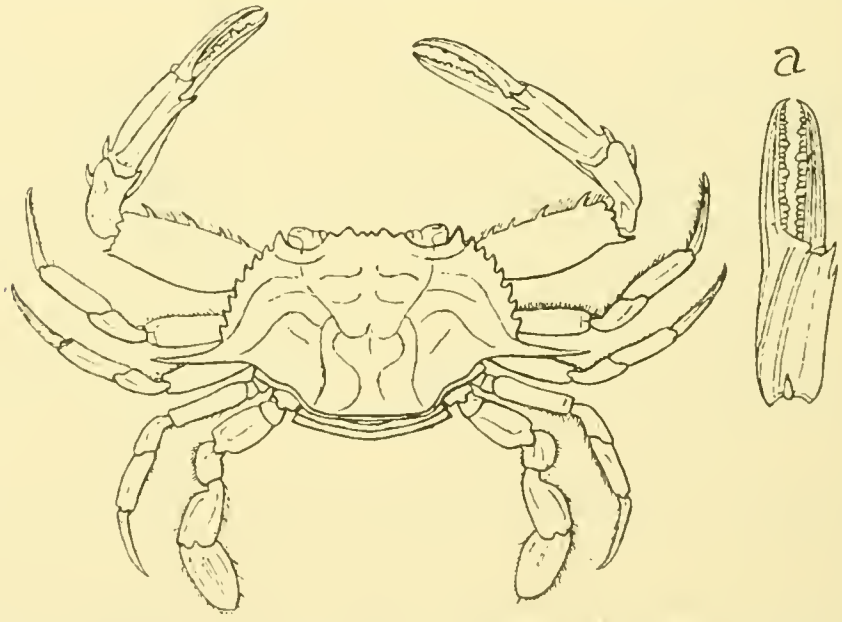

Figure 26.—*Acheloüs anceps*, female, enlarged $1\frac{1}{2}$ times; *a*, chela. After Saussure.

the two distal spines, one behind the other, on the chelæ, besides other obvious characters. The two middle frontal teeth are much smaller than the others. The lateral teeth are acute and curve

* Miss Rathbun (loc. cit.), in her analytical table, placed *anceps* in a group with short posterior lateral spines. She informs me that she then had another species in mind.

forward. This appears to be a small species. The Bermuda specimens taken in Castle Harbor, March and April, 1901, were all small; in life the carapace was usually mottled with gray and yellowish white, so as to imitate the color of the sand pretty closely. The first pair of ambulatory legs in some were yellow, in others red; the chelipeds and other legs had, in part, the same colors. Perhaps the difference was sexual; both sexes were in the lot noted.

The colors soon fade in alcohol or formol to uniform yellowish or salmon, with a tinge of red on the tips of the chelæ. The ratio of length to breadth, less spines, is from 1:1.5 to 1:1.60. All our specimens are small, but apparently about adult, as several carry eggs.

Measurements of specimens.

		Carapace			Front	Chelæ		
			breadth	br'dth	bet.			
No.	Sex	length	total	—spines	orbits	length	height	Locality
4038, fig.		12	24	18	5.5	17	3.5	Bermuda
4044	♂	13	26	20	5.5	19	3.5	Bermuda
4045*a*	♀ eggs	13	25	19	5	17.5	3.5	Off Hatteras
4045*b*	♀ eggs	12.5	25	19	5	16	4.25	Off Hatteras

Our largest male has the carapace 16^{mm} long and 32^{mm} wide, including the lateral spines, or 24^{mm} without the spines.

One Bermuda specimen, taken in April (No. 4060) carried eggs. Similar specimens were taken in a seine at Nonesuch I., Sept. 4, 1905, by the party from the Field Mus. Nat. History (No. 158), one of which carried a large mass of eggs, indicating sexual maturity, but probably not full size.

Specimens taken in 7 fathoms, off Cape Hatteras, by the "Albatross," station 2288, Oct. 20, 1884, average a little larger. Three of them (No. 4045, *a*, *b*, *c*) carried large clusters of eggs; these were all 12 to 14^{mm} in length of carapace.

It is not uncommon at Bermuda, in the shallow waters of sheltered sandy bays. Our specimens were taken in March and April, mostly in Hungry Bay and at "Waterloo," near Walsingham Bay, Castle Harbor.

Its known range is from the Antilles to Cape Hatteras. Off C. Hatteras, 7–16 fathoms (Smith).

It seems to me probable that *N. ventralis* A. M.-Edw. (op. cit., fig. 3) is identical with this species, with which it agrees in nearly all details. Miss Rathbun gives measurements of *ventralis* from Porto Rico as follows: length of carapace, 15^{mm}; total breadth, 30^{mm}; breadth less spines, 23.7^{mm}. The proportions, therefore, are the same as some of those in my table.

Achelous Sebæ (H. M.-Edw.) Smith.

Portunus sanguinolentus (*pars*) Latreille, Encyc. Method., pl. 272. fig. 6. (*non* Herbst sp. *nec* Stimpson).

Lupa Sebæ H. M.-Edw., Hist. Nat. Crust., i, p. 455, 1834.

Neptunus Sebæ A. M.-Edw., Arch. Mus. Hist. Nat., x, p. 329, pl. xxviii, figs. 2, 2*a*, 1861; Miss. Sci. Mex., v, p. 217, 1879.

Achelous Sebæ S. I. Smith. Crust. Brazil, these Trans., ii, p. 34, 1869 (Brazil).

Portunus (*Achelous*) *Sebæ* Rathbun, Brach. and Macr. Porto Rico, p. 46, 1901.

FIGURE 27.

This fine species grows to large size. It is easily recognized by an upright, acute spine on the basal joint of the posterior legs, and a small spinule on the outer distal angle of the merus joint of the same legs; and when recent by a pair of large round red spots on the flanks of the carapace. But these spots are liable to fade in alcohol, and in dry specimens exposed to light, becoming pale yellow.

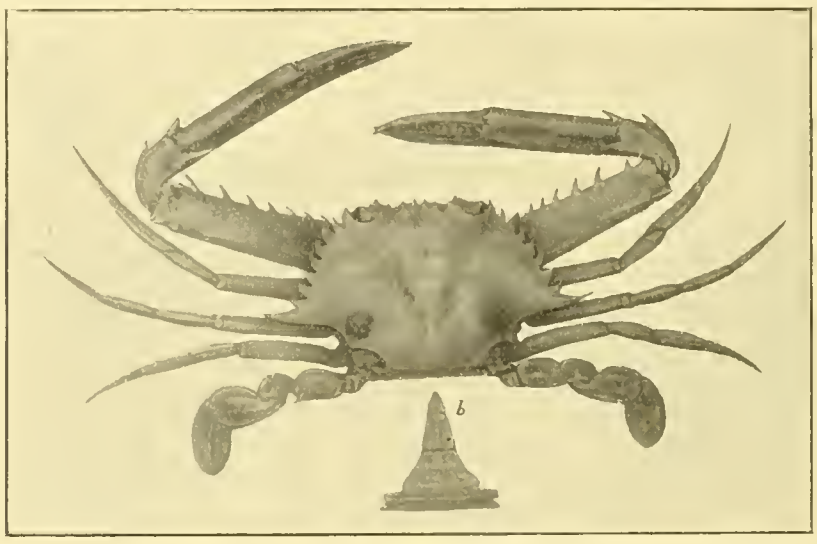

Figure 27.—*Achelous Sebæ*, about $\frac{1}{3}$ nat. size; *b*, abdomen of male. After A. M.-Edwards.

It is said to be the only species having an upright spine on the basal joint of the swimming legs.

The chelæ have two distal dorsal spines, one behind the other. The middle two frontal teeth are a little more prominent than the outer ones, which are more acute. The inner orbital tooth is acute. The posterior lateral tooth is sharp, rather long, somewhat curved forward, and bears the small preceding tooth on the inner basal portion.

In life the carapace and legs are closely pubescent and the legs and chelipeds are fringed with longer red hairs. The merus of the

chelipeds has six sharp spines on its anterior edge with a close fringe of long red hairs above, and a smaller one below them ; it has also a sharp distal spine on the posterior side. There are three sharp dorsal spines on the manus : the proximal at the joint, one sharp and curved toward the distal end, and a smaller one at the extreme end. Carpal spines two, very sharp. Nearly all the spines are red at base with a pale middle band and darker tip. The dactylus has a dorsal fringe of red hairs. The general color of preserved specimens is pale orange yellow ; three faint reddish bands on the legs and chelæ ; fingers red.

Measurements.

No.	Sex	Carapace length	Carapace breadth total	Carapace breadth —spines	Front between orbits	Chelæ length	Chelæ height	Locality
47*	♀	45.2	89	—	—	r. 56 / l. 60		Bermuda
4084*a*	♂	45	91	69	20	r. 69 / l. 68	r. 15 / l. 14	Dominica

* No. 47 was measured by Prof. S. I. Smith (Goode's coll.).

This species has rarely been taken in the Bermudas. An adult female was obtained by Mr. G. B. Goode in 1876 (coll. Wesleyan Univ.). It probably lives in rather deep water. Large specimens collected at Dominica I., Antilles, in 1906, were taken in fish-nets, in shallow water (A. H. Verrill, Yale Mus.).

Its range extends from North Carolina through the West Indies to Brazil. Martinique and Brazil (Edw.) ; Porto Rico (Rathbun).

Achelous Ordwayi Stimp. *Silvery-clawed Crab.*

Achelous Ordwayi Stimpson, Notes on N. Amer. Crust., ii, p. 96 [224], 1860 (Florida and St. Thomas) : Bulletin Mus. Comp. Zoöl., ii, p. 148. S. I. Smith, Brazilian Crustacea, these Trans., ii, p. 9, 1869 (descr.).

Neptunus Ordwayi A. M.-Edw., Arch. Mus., p. 450, 1861, Addenda ; Miss. Sci. Mex., p. 217, pl. xl, fig. 2–2*b*, 1879.

Portunus (*Achelous*) *Ordwayi* M. J. Rathbun, Bulletin Labr. Nat. Hist. Univ. Iowa, 1898, p. 276 ; Brach. and Macr. Porto Rico, p. 46, 1901.

Figures 28, 29. Plate XVIII, Figure 3.

This species is easily recognized by the smooth silvery or iridescent area on the outer surface of the chelæ. The four frontal teeth are narrow, prominent, and subacute ; the inner orbital tooth is simple, triangular and acute. The posterior lateral tooth is larger than the others, but not very long ; it is sharp and curves forward ; all the other teeth curve forward. The carapace and legs are pubescent

in life, and the legs are fringed with longer hairs; the hairs on the front edge of the merus of the chelipeds are red and long, forming a close fringe concealing the four large spines; there is another fringe of long hairs near the lower edge. The manus has but one distal spine, and a long proximal spine at the carpal articulation. The manus lacks the subdorsal ridge present in the other species, its place being covered by the iridescent patch; the dorsal ridge is subcarinate; its edge is obtuse and fringed with a row of red hairs on each side; it terminates in a strong sharp spine, slightly hooked inward, situated at about the distal fourth of the edge.

The areolations of the middle of the carapace, on perfect dry specimens, from which the pubescence has not been rubbed, form a rather conspicuous and curious face-like or mask-like figure, more noticeable than in the allied species.

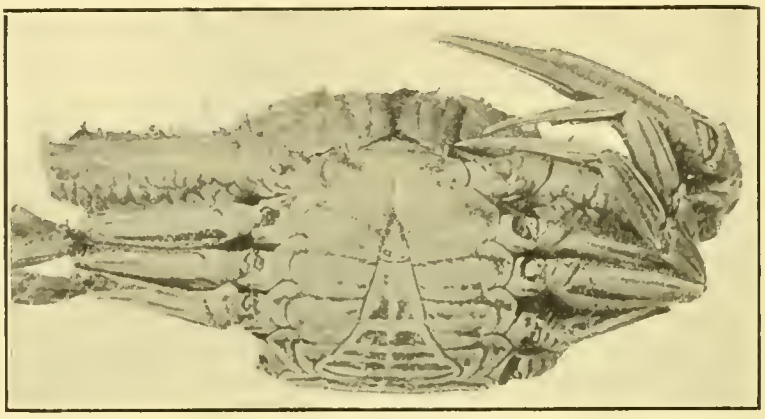

Figure 28.—*Achelous Ordwayi*, under side of carapace of male, nat. size. Phot. A. H. V.

Specimens, with the carapace 32 to 38^{mm} long, taken April, 1901, in Castle Harbor, were in life more highly colored than the smaller ones. The carapace and legs were finely and elaborately variegated and mottled with red, yellowish brown and gray, producing the general effect of reddish brown. A small whitish spot, bordered with brown, appeared behind the bases of the posterior lateral spines. The under side was pale orange, pinkish around the month, deeper orange on the chelipeds and legs; and with some spots of orange-brown on the basal segments of the abdomen. The chelæ, above, were deep red-brown, the fingers crossed by two light orange-red bands; the iridescent area on the outer surface reflected prismatic colors, but especially green, red, and silvery tints. The iridescent

areas may be of use in attracting the sexes in the pairing season, but perhaps they may also serve for a lure to attract small fishes, or other prey. We had no opportunity to study this matter. One would naturally suppose that they might also attract enemies in the shape of larger predacious fishes, many of which are well known to be attracted by a white or bright metallic bait. But it must happen that the advantage gained is more than the disadvantage, or else the species would have become extinct.

Younger specimens, noted by my son, C. S. Verrill, in April, 1898, had the following colors in life: Carapace light gray, with darker shades over the cardiac region, and around the edges of the carapace. Ventral surfaces white. Chelipeds light gray, purple at the joints.

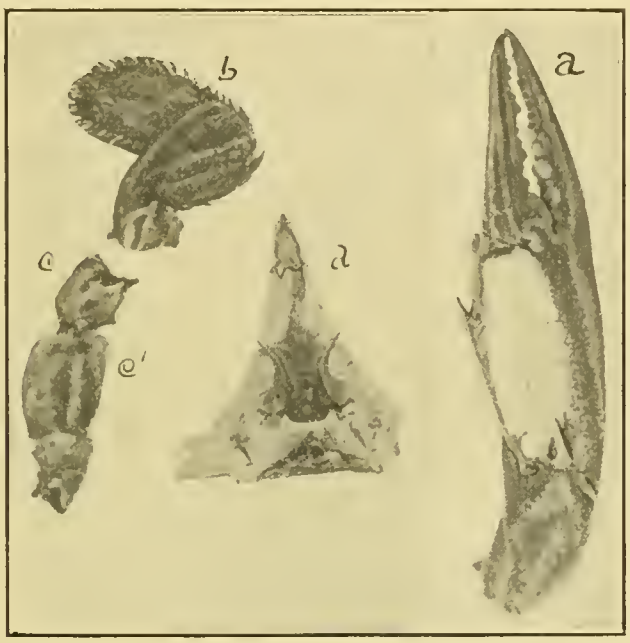

Figure 29.—*A. Ordwayi*, *a*, one of the chelæ, showing the iridescent area, × 1½; *b*, *c*, parts of swimming leg; *c'*, denticulated angle of merus; *d*, verges and abdomen of male, enlarged. Phot. A. H. V.

Ambulatory legs light gray, except the posterior legs, which have a red blotch on the last joint. Eye-stalks light gray, the eyes black. Chelæ with a brilliant iridescent area.

In alcohol the colors soon fade and the general color becomes yellowish or salmon, often showing some red mottlings; two bands of pale red often cross the chelæ, and the tips of the digits may be pale red; the fringe of long hairs on the merus often long retains its red color in alcohol.

Measurements.

No.	Sex	Carapace length	Carapace breadth total	Carapace breadth —spines	Front between orbits	Chelæ length	Chelæ height —spine	
4037	♂	24	36	30.5	10	27	7	Bermuda
3162	♂	25.5	39	34	10.5	28	7	Bermuda
4087	♂	22	35	28	9.5	25	6	Off Hatteras
4083	♂	33	52	45	18.5	r. 37	10	Dominica
4083*a*	♀	33	51	43	11	r. 37	9.5	Dominica

This interesting species is not uncommon at Bermuda, in suitable localities. It lives in shallow bays, with whitish shell-sand bottoms. We found it near and at Walsingham Bay on Castle Harbor; Hungry Bay; the north side of Long Bird Island, at "The Reach," etc. It can rarely be caught except by the use of nets. It was also in the collections of J. M. Jones, G. Brown Goode, and the Field Museum of Natural History.

The type localities were Florida and St. Thomas.

It was taken off Cape Hatteras, in shallow water, by the U. S. Steamer "Albatross." It ranges from North Carolina through the W. Indies to Brazil. Off Florida Keys, 5-7 fathoms (Stimpson). Bahia, Brazil (Smith).

This species was dedicated to Albert Ordway, a classmate of the author, while a student of Professor Louis Agassiz, 1858 to 1861.*

* Mr. Ordway was, at that time, an enthusiastic student of Crustacea, and a young man of much ability. His best known work on Crustacea, written at that time, but published later, is that on the genus Callinectes (see Bibliography), in which he first demonstrated the great systematic importance of the form and structure of the male appendages in this family, and applied his discovery to the correct elucidation of the numerous species of this group, to which he also added six new species.

During the winter and spring of 1860 and 1861, the writer spent several months in Washington closely associated with Mr. Ordway and several other young zoölogists, among whom were Dr. Wm. Stimpson, E. D. Cope, Theodore Gill, Elliott Coues, F. W. Putnam. We were engaged in working upon the collections of the Smithsonian Institution, by the requests of the Secretary, Prof. Joseph Henry, and Assistant Secretary, Prof. S. F. Baird.

At that time the writer remembers seeing Dr. Stimpson, who was at first skeptical, give Mr. Ordway a severe test, as to his ability to distinguish the various forms of *Callinectes* by his new method. He put before him all the specimens in the large Smithsonian collection with no labels except catalogue numbers. Mr. Ordway very rapidly and correctly separated them, not only into their species, but assigned each to its proper geographical area, greatly to the surprise of Dr. Stimpson and others.

At the time when we were in Washington, political and sectional excitement was at fever heat, and the presentment of impending war was almost universal,

Achelous spinimanus (*pars*, Latr.) DeHaan.

? Portunus spinimanus (*pars*) Latreille, Encyc., t. x, p. 188 (*teste* A. M.-Edwards); Nouv. Dict. Hist. Nat., xxviii, p. 47, 1819.

? Lupa spinimana Leach, Desmarest, Consid. gén. sur la classe des Crust., p. 98, 1825. ? H. M.-Edwards, Hist. nat. Crust., i, p. 452, 1834. Gibbes, op. cit., p. 178. Dana, United States Expl. Exped., Crust., p. 273. Stimpson, Annals Lyc. Nat. Hist., New York, vol. vii, p. 57.

? Achelous spinimanus DeHaan, Fauna Japonica, Crust., p. 8, 1833. White, List Crust. Brit. Mus., p. 28, 1847. Stimpson, Annals Lyc. Nat. Hist., New York, vol. vii, p. 221, 1860. A. M.-Edwards (*pars*), Arch. Mus. d'Hist. nat., lx, p. 341 (*non* pl. xxxii, fig. 1, 1*b*), 1861;* Miss. Sci. Mex., v, p. 230, pl. xxxix, figs. 2, 2*a*, 1879. Smith, Crust. Brazil, these Trans., ii, p. 9 (measurements, p. 34). S. I. Smith, Annual Report U. S. Fish Comm., for 1885, p. 30, 1886. Rankin, Trans. N. York Acad. Sci., xi, p. 233, 1898 (Bermuda).

Achelous spinimana Kingsley, Proc. Acad. Nat. Sci., Philad., 1878, p. 5.

Portunus (*Achelous*) *spinimanus* M. J. Rathbun, Bull. Lab. Nat. Hist. Univ. Iowa, 1899, p. 276; Brach. and Macr. Porto Rico, p. 45, 1901 (descr.).

Figures 30, 31.

The front is rather prominent. The inner orbital tooth is bilobed, its outer lobe with the four median teeth making six unequal frontal teeth, not including the inner lobe of the bilobed orbitals, of which

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Mr. Ordway was very patriotic and took great interest in the exciting events of the time. Probably the unusual excitement of that time and place had much to do with his entering the army a little later.

When the war broke out he immediately enlisted and remained in the Army of the Potomac through the entire war. He distinguished himself for bravery and efficiency on various occasions and was rapidly promoted. At the close of the war he had attained the rank of Brevet Brigadier General, Aug. 13, 1865. After Richmond was captured he was appointed Provost Marshal of the city. He eventually married there and continued to live there some years, engaged in business, but he never resumed his zoölogical studies after the war.

He afterwards resided in Washington, D. C., and was Commander of the National Guard of the District of Columbia, and at one time Commander of the Loyal Legion. He was also president of the American Ordnance Company.

General Ordway was born in Boston, 1843. He died in New York, Nov. 21, 1897.

* The figure given by A. M.-Edwards, in this work, represents a species from the coast of Chili. It is evidently distinct from the one figured in his subsequent work from the West Indies. Which of the two is the true *spinimanus* of Latreille seems doubtful, but the name is now commonly applied to the West Indian species, or to both.

Probably all the early writers, cited above, confounded two or more species under this name. Their descriptions are too brief and indefinite to determine species of this genus. Probably the figure of the Chilian species given by A. M.-Edw. affords the earliest means for the accurate determination of any of those included under this specific name. If so, the name ought to be restricted

the middle two are distinctly larger than the others. The middle four are all rather elongated, and subacute. The posterior lateral tooth is stout, rather curved forward. The others are all nearly equal in size, acute. The merus of the chelipeds has five stout, rather close anterior teeth* and a large posterior distal one, according to Edwards' figure. The manus has a single distal tooth on a strong carina, at the distal fourth. This species, in respect to its areolation, lateral teeth, and six frontal teeth, is similar to *A. Smithii*, but in the latter the frontal teeth are blunt and the middle ones are less prominent; it also differs in having the merus of outer maxillipeds more prolonged. The chelipeds are shorter and stouter, the merus particularly so; its large posterior distal tooth seems to be distinctive. Personally I have seen no specimens agreeing well with Edwards' figure and description of 1879.

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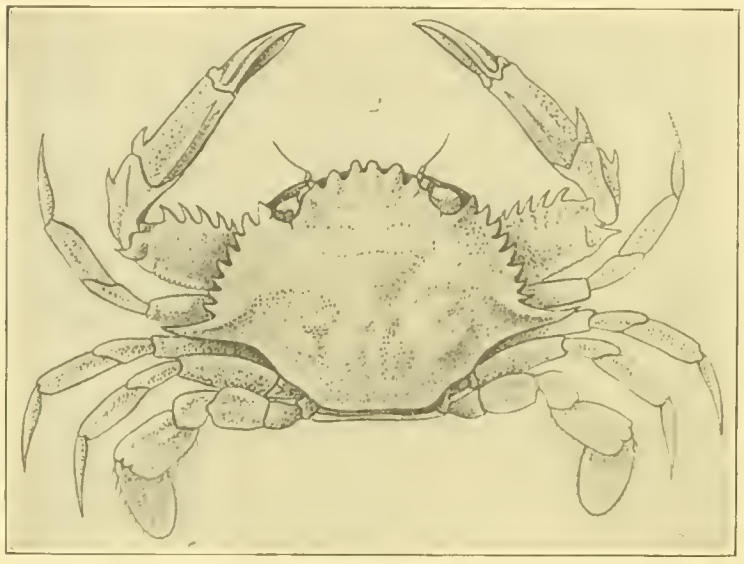

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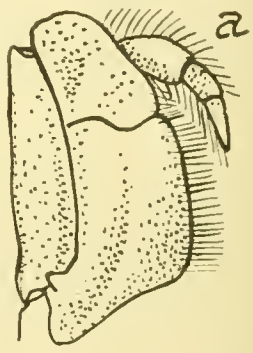

Figure 30.—*Achelous spinimanus*, about $\frac{1}{2}$ nat. size; 31, maxilliped, enlarged. After A. M.-Edw.

Measurements for ratio of length to total breadth. (Part, *A. Smithii.*)

Length of carapace including frontal teeth	Breadth of carapace including spines	Ratio of length to breadth	Locality
37.0mm	61.5mm	1:1.66	Brazil (Smith)
44.4	77.4	1:1.74	Brazil (Smith, 829 ♀)
56.0	95.0	1:1.70	Brazil (Smith)
54.2	90.0	1:1.65	Porto Rico (Rath.)

to the Chilian species. In that case the Atlantic species should take the name, *A. Smithii*, unless there be an earlier one. None of the early writers, before A. M.-Edw. have given a figure of either form, so far as I know.

* Miss Rathbun, 1901, gives, in her description, only four, as in *Gibbesii*. In our No. 829, there are four on one side and five on the other.

In No. 829 the larger chela is 54^{mm} long; 15^{mm} high; breadth of carapace, less spines, 66^{mm}. This appears to be the adult of *A. Smithii.*

This species appears to be very rare in Bermuda. It has been reported only by Dr. Rankin. Its recorded range is from off Cape Hatteras, 13 fathoms (Smith),* to Rio Janeiro, Brazil.

Florida (Stimpson). Bahia, Brazil, and Egmont Key, W. Florida (Smith). Bahamas in *Sargassum* (Rathbun).

Achelous spinimanus, var. or subspecies **Smithii**, nov.

Achelous spinimanus (*pars*) Smith, Rep. Decapod Crustacea, Ann. Report U. S. Comm. Fish and Fisheries for 1884, p. [30], 1886.

Figures 32, 33. Plate XIX, Figures 2, 2*a*. Plate XXI, Figure 2.

Carapace strongly areolated, and with unusually prominent, arched, transverse ridges, which are coarsely granulated on the front edge; elsewhere the surface is closely covered with minute hairs and granules; a fringe of long marginal hairs between and on the lateral teeth.

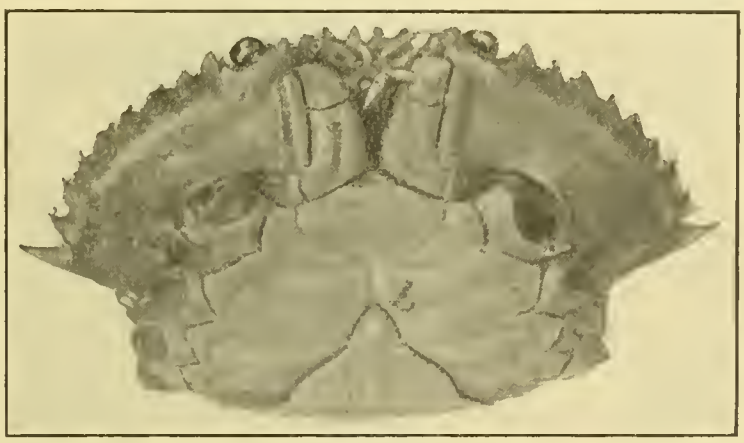

Figure 32.—*Achelous Smithii:* ventral side of young female, about 1¼ nat. size.. Phot. A. H. V.

The inner orbital tooth is bilobed, so that there are six frontal teeth, not counting the inner lobe of the orbital, which is rather shorter than the outer lobe. The four true frontal or rostral teeth are a little prominent, subacute, the two middle ones a little smaller and scarcely more prominent than the others.

* The smaller specimens from this locality, which I have examined, proved to be a distinct form (*A. Smithii* nov.), but there were larger ones that I have not seen, now in the U. S. Nat. Museum, which may be the *spinimanus* of Edw., 1879.

Of the lateral teeth, the first eight are subequal, all acute and curved forward; the third is a trifle wider; posterior lateral tooth not very large, about twice as long as the preceding, acute, curved a little forward. Merus of chelipeds with four strong anterior spines directed forward, and sometimes a small or subobsolete distal posterior one, which may be wholly lacking; two carpal spines rather short. Manus with a strong dorsal carina, ending in a sharp divergent tooth at about the distal fourth. Merus of swimming feet broader distally, its posterior distal angle armed with a very small sharp spine and several more minute, acute denticles.

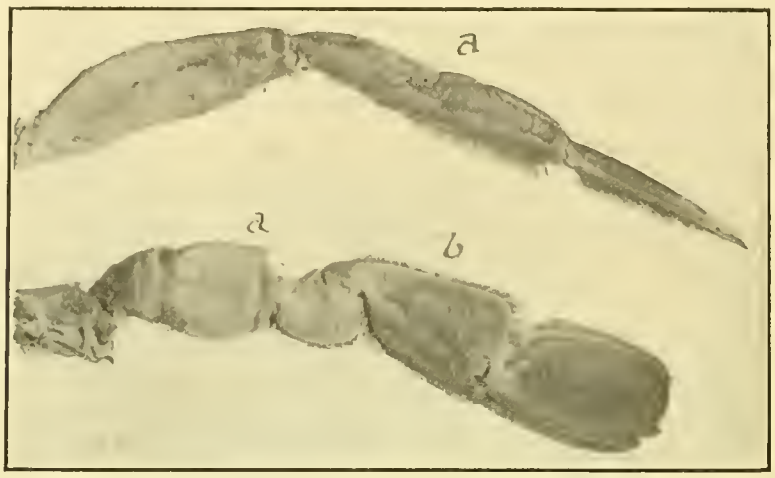

Figure 33.—*Achelous Smithii; a*, first ambulatory leg; *b*, swimming leg; *d*, denticulated angle of merus, enlarged. Phot. A. H. V.

This form is very closely allied to *A. spinimanus*, from which it is best distinguished by the less prominent front; the smaller and nearly equally prominent frontal teeth; the shorter and weaker posterior lateral spines; and by the small or nearly obsolete posterior distal spine of the merus of the chelipeds. The chelipeds are also longer. Some of our specimens (No. 4035) were catalogued as *A. spinimanus* by Prof. S. I. Smith, who depended on the figure of A. M.-Edwards. The type specimens, here described and figured, are from that lot.

Measurements of Types and Cotypes.

		Carapace			Front	Chelipeds		
			br'dth	br'dth	bet.		height	
No.	Sex	l'gth	total	—spines	orbits	length	—spines	Locality
4035*a* fig.	♂	26	42	36	9.5	r. 29	7.5	Off Hatteras
4035*b*	♀	29	48	42	10	33	8	Off Hatteras
4049	♀	26	44	37	11	l. 28	7	Ft. Macon

The ratio of length to breadth, not including large lateral spines, is 1: 1.40 to 1: 1.45.

Young specimens of this form were not uncommon at Bermuda, in masses of *Sargassum*, associated with *Portunus Sayi* and *Planes minutus*. It was also taken by the Bermuda Biological Station in July, 1905, in *Sargassum*.

The larger specimens are from Fort Macon (Yale Mus., coll. Dr. Yarrow, 1871); off Hatteras, in 13 fathoms (U. S. Fish Comm. Steamer "Albatross," Oct., 1884, sta. 2285); West Florida (Coons coll., Yale Mus.); and Brazil.

Achelous Gibbesii (Stimp.).

Lupa Gibbesii Stimpson, Notes on N. Amer. Crust., i, Annals Lyc. Nat. Hist. N. York, vii p. 57 [11].

Achelous Gibbesii Stimpson, Notes, I, op. cit., vii, p. 22 [94], 1860 (Beaufort, N. C.).

Neptunus Gibbesii A. M.-Edw., Nouv. Arch. Mus. Nat. Hist. Paris, x, p. 326, pl. xxxi, figs. 1, 1*a*, 1*b*, 1861; Miss. Sci. Mex., p. 213, 1879.

Achelous Gibbesii Smith, Ann. Rep. U. S. Comm. Fish and Fisheries, for 1882, p. 349, 1884 (off Hatteras); op. cit., for 1885 [p. 30], 1886 (off Hatteras), Kingsley, Proc. Philad. Acad., for 1879, p. 398.

Portunus (*Achelous*) *Gibbesii* M. J. Rathbun, Amer. Naturalist, xxxiv, p. 140, 1900.

FIGURES 34, 35.

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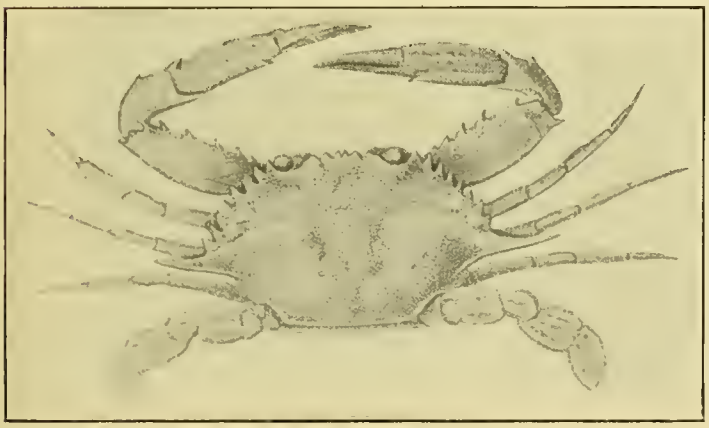

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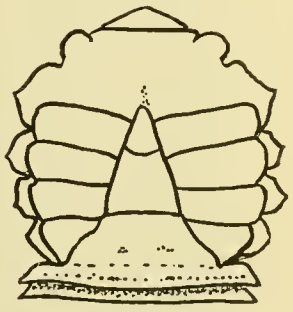

Figure 34.—*Achelous Gibbesii*, young, × 1½. After A. M.-Edw.
Figure 35.—The same, abdomen of ♂, enlarged. After A. M.-Edw.

This species, which is introduced here mainly for convenient comparison, is not yet definitely recognized as native of Bermuda. The few specimens most resembling it are too young for positive determination.

It has four small, nearly equal rostral teeth, besides the obitals, which are slightly bilobed (scarcely at all in the young); the merus

of the chelipeds has five sharp teeth on the front margin ; the lateral spines are long and sharp, curved forward a little ; there are usually one or two round silvery spots near the bases of the anterior marginal teeth, on each side. It is a rather small species. A female with the adult form of the abdomen, from Egmont Key, Fla., has the carapace only 20^{mm} long, 40^{mm} wide, including spines.

A female from Ft. Macon, N. C. (coll. Dr. Yarrow, 1871, No. 4087), has the adult form of the abdomen, but no eggs. Its carapace is 25^{mm} long; 51^{mm} broad with spines; without spines, 40^{mm} wide; length of chelæ, 31^{mm}; height, 7.5^{mm}.

The four inner frontal teeth are about equal in length, but the two inner are narrower. The merus of the swimming legs has a row of 5 or 6 small acute spinules on its posterior distal edge, the outer ones longer. The anterior two pairs of legs are flattened, with the merus as well as the distal segments fringed. The distal end of the dorsal carina of the chelæ is sub-spiniform, so that in profile it looks a little like a second spine, in front of the principal one, which is sharp and divergent. The manus has five strong granulated ribs on the superior and outer surfaces, with deep hairy grooves between them. The dactylus has four ribs, besides an inner one. The surface of the ribs, when the hairs are removed, is shining or silvery. The carapace is strongly granulated and hairy ; the small silvery spots* are very distinct. The merus of the right cheliped has six inner marginal spines, that of the left cheliped only five. They are sharp and directed forward, but not so near together as in the figure; usually there are but five.

The chelipeds are very long, being longer than in the figure. The length of the merus exceeds half the total breadth of the carapace. The chelæ and carpi are also elongated. When extended, the expanse of the chelipeds is seven times the length of the carapace. In a male (981*a*) the carapace is 24^{mm} long; expanse of chelipeds, 168^{mm} ; when folded the end of the merus projects 15^{mm} beyond tip of the lateral spine. The ambulatory legs are also long and much flattened.

Off C. Hatteras, Str. "Albatross," Nov. 9, 1883, sta. 2107, in 16 fathoms, three, one with eggs (Smith) ; off C. Hatteras, 5 stations, 13–48 fath., 1884, 16 specimens, 1886 (Smith).

* These spots are variable in form and number and are often lacking on one side. They look as if they might have been made by the tips of the claws of the opposite sex during the mating season. The surface of the carapace becomes silvery whenever the hairs are rubbed off by friction.

Beaufort, N. C., and West Florida (Kingsley). Egmont Key, Fla., No. 981, and Fort Macon (Yale Mus.).

Achelous depressifrons Stimp.

Amphitrite depressifrons Stimpson, Notes, No. I, Annals Lyc. Nat. Hist. N York, vii, p. 58 [12],1859.

Achelous depressifrons Stimp., op. cit., p. 223 [95], 1860. A. Milne-Edw., Arch. Mus. Nat. Hist., x, p. 342, 1861 ; Miss. Sci. Mex., v, p. 230, pl. xl, fig. 4, 4*a*, 1879. Coues, Proc. Acad. Nat. Sci. Philad., for 1872, p. 121 (Fort Macon). Kingsley, Proc. Acad. Nat. Sci., Philad., for 1878, p. 5. Rankin, N. York Acad. Sci., p. 233, 1898.

Neptunus depressifrons Miers, op. cit., p, 181, 1886. Rankin, Annals N. Y. Acad. Sci., xii, p. 531, 1900.(Bermuda).

Portunus (*Achelous*) *depressifrons* M. J. Rathbun, Bull. Lab. Nat. Hist. Univ. Iowa, 1878, p. 27 ; Brach. and Macr. Porto Rico, p. 45, 1901.

Figure 36. Plate XX, Figure 3.

This is easily distinguished from most of the other Bermuda species by the shorter posterior lateral spine, which is scarcely longer than those in front of it. The front is not at all prominent;

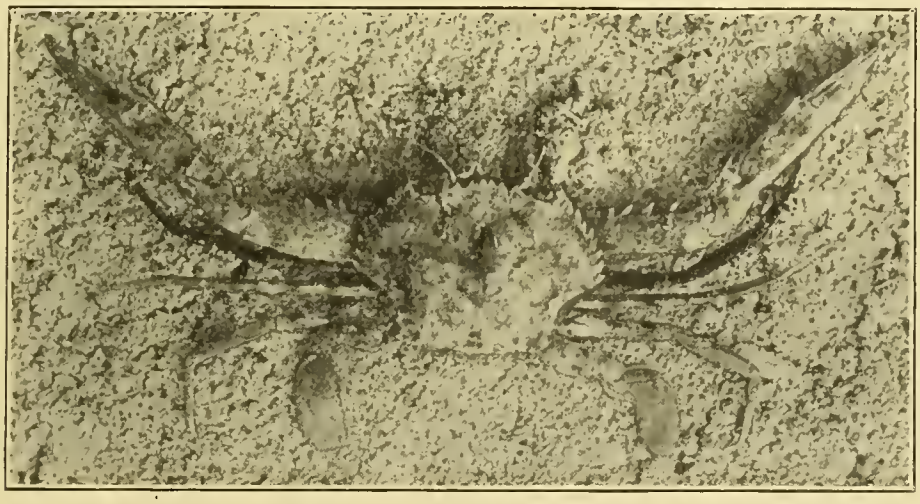

Figure 36.—*Achelous depressifrons*, resting on shell-sand, to show protective coloration. Nat. size. Phot. A. H. V.

its four rostral or true frontal teeth are very short, blunt, subequal, and close together ; most frequently the middle two are a little smaller than the others; in other cases they equal or a little exceed them in length.

The inner orbital tooth is broad, with the frontal angle dentiform and the middle of the margin a little concave, but not bilobed.

The carapace is strongly areolated and has prominent, but thin, curved transverse ridges or crests, sharply granulated on their edges. The areolations of the gastric region form a conspicuous mask-like figure, when dry. The depressed areas are mostly covered with minute, sharp, but not very close granules, which bear minute rough hairs to which dirt often adheres; the legs are similarly clothed, except the small glossy areas. The edges of the carapace and marginal teeth are fringed with longer hairs.

The chelipeds are unusually long. The ambulatory legs are notably long and slender, the first pair rather longer than the others; the three distal segments of the front legs are somewhat flattened and well fringed with long hairs below, thus somewhat approaching the form seen in those of *Portunus Sagi*, but less flattened and less remiform. The legs of the second and third pairs are only slightly flattened and lightly fringed. The basal and merus segments of the swimming feet are unarmed; the distal end of the merus is rounded.

The marginal teeth are all similar in form and size, very acute, curved forward and upward.

The merus of the chelipeds has an anterior row, usually of six, slender, sharp spines, unequally spaced, the first very small, increasing in size distally, the last at the distal angle; posterior distal spine reduced to a tubercle or obsolete; carpal spines two, the inner longer, of moderate length, banded with red. The manus has a prominent dorsal carina, curved over to the inside, leaving a fringed groove beside it; it bears, at the extreme distal end, a single, acute, nearly straight tooth, directed forward. The dactylus is strongly grooved; the dorsal side is fringed with long hairs; the thumb has two fringes. The hand has five ribs on the outer, under, and upper sides; the middle outer one is much the stronger, so that the form of the hand is rather triquetral in an end view. There are small smooth areas between the ribs and on the carpus and fingers, which are glossy or lustrous when dry.

In life the carapace is irregularly mottled with light and dark gray, closely imitating the colors of the sand; the chelipeds and posterior legs are similar, though paler; but the first pair of ambulatory legs, which are longer than the others, are bright purple or deep blue in the larger specimens, while some portion of the same color is usually seen on the next two pairs, but the color of the first pair is in striking contrast with that of the rest of the crab. This has, no doubt, some useful purpose, but as it appears in specimens apparently too young to mate, it is probably not a sexual attraction.

Perhaps these long slender legs may be spread out on the surface of the sand to imitate annelids and so serve as a lure for small fishes. We had no opportunity to test this proposition. The very young specimens did not show this distinction in the color of the legs, so far as observed.

Measurements of Bermuda specimens.

No.	Sex	Carapace length	Carapace breadth total	Carapace breadth —spines	Front bet. orbits	Chelæ length	Chelæ height
4048	♀	20	28	27	7	21	7
4055*a*	♂	17	25	24	6	25	6.5
4055*b*	♂	16	23	22	5	22	5
4055*c*	♀	15	22	21	4		
3038	♂ fig.	17	25	24	5.5	24	6

The total expanse of the extended chelæ in 4055*a* was 104^{mm}; total length of cheliped, 47^{mm}; extent beyond the edge of the carapace, 40^{mm}.

When recently dried there are small smooth areas on the carapace and legs, especially the last pair, that are lustrous and somewhat iridescent; most of the under side of body and legs is smooth and shining.

At Bermuda it is a very common species. We found it abundant in shallow water in April, 1898 and 1901, on the sandy bottoms of sheltered coves and inlets, as near Walsingham Bay, Coney Island, Hungry Bay, etc.

It was also contained in the early collections of J. M. Jones, Dr. F. V. Hamlin, G. B. Goode and others. Most of the more recent collectors have also taken it, but all the specimens that I have seen are small and probably immature, for none bear eggs. It was originally described by Dr. Stimpson from Charleston, S. C. and Beaufort, N. C. Its range extends from Cape Hatteras to the Antilles. Fort Macon, N. C. (Dr. Yarrow); Bahamas (Rankin); Culebra (Miss Rathbun).

Charybdella tumidula (Stimp.) Rathbun.

Achelous tumidulus Stimpson, Bull. Mus. Comp. Zoöl., ii, p. 149, 1871.

Neptunus tumidulus A. M.-Edw., Miss. Sci. Mex., Crust., p. 218, 1879. Rankin, Annals N. York Acad. Sci., xi, p. 233, 1898 (Nassau).

Cronius bispinosus Miers, Voy. Chall., Zoöl., vol. xvii, p. 188, pl. xv, fig. 2, 1879.

Charybdella tumidula M. J. Rathbun, Brach. and Macr. Porto Rico, p. 51, 1901.

Plate XIX, Figure 1.

Our single Bermuda specimen is considerably larger than those from Porto Rico, described by Miss Rathbun, and very much larger

than Stimpson's type. On this account, probably, it does not fully agree with either description.

The carapace is relatively wider than stated by Stimpson ; the ratio of length to breadth, minus lateral spines, is 1 : 1.33. The carapace is strongly areolated, and has conspicuous, curved transverse ridges with sharp, granulated anterior edges. Its surface is well covered with fine and rather short hairs, arising from fine granulations, and with a fringe of longer hairs on the lateral and frontal margins. The legs are also pubescent and fringed with slender hairs.

The four true frontal teeth are conspicuous ; a little prominent ; and all are of nearly the same form and breadth; they are obtusely rounded at the end ; the two middle ones are a little longer and a trifle narrower than the others, with the middle notch a little narrower ; the notch between the outer of these and the next tooth (bilobed orbital) is deeper and narrow. The orbital is distinctly bilobed, the outer lobe being a little larger and longer than the other, but not so long or large as the true frontal teeth.

The nine marginal teeth are alternately large and small ; the small ones, which are the 2d, 4th, 6th and 8th, lack the naked sharp tips seen on the 3d, 5th, 7th and 9th. The 8th is the smallest. The first, or outer orbital, is broader than the others, with the outer side broadly arched. The others are all strongly curved forward and acute, fringed with hairs on the edges. The last, or 9th, is not much longer than the 7th, but twice as long as the 8th ; it is less curved forward than the others and bends a little upward.

The chelipeds are long and large ; about two-thirds of the merus projects beyond the edge of the carapace ; it has four stout, naked-tipped, sharp granulated spines on its front edge, of which the proximal is smallest ; the distal posterior spine, usually present in this group, is lacking.

The carpus has a very small outer spine, and a much larger inner one, which is slightly curved forward and very sharp, but it reaches less than one-third the length of the upper side of the manus, being, therefore, much shorter than in Stimpson's and Miss Rathbun's specimens. The proximal or articular spine of the manus is of moderate size; the distal dorsal one is rather larger, strong at base, very sharp, divergent ; its front edge is situated at about the distal third of the dorsal edge. The surface of the chelæ is covered with short hairs and is granulated ; there are four strongly granulated ribs besides the dorsal one on the outer surface, but no additional spine.

The dactylus has two sharply denticulated dorsal carinæ and two strong granulated lateral ribs on the outside, with deep grooves between them.

The left cheliped is considerably smaller, but otherwise is much like the right, though the dorsal carina of the manus, in this, ends in a prominent angle distally, but not forming a true spine.

Ambulatory legs are of moderate length, not much flattened, finely fringed. The merus of the swimming feet has the distal posterior end rounded and very finely denticulated, but without a spine. The segments of the male abdomen are crossed by depressed areas, covered with fine scale-like hairs. The male generative organs are thick at base, strongly convergent, then divergent, with slender flexuous tips, which reach a little beyond the middle of the penultimate segment.

The color of the alcoholic specimen is pale orange yellow, with a pair of ill-defined rounded spots of light red on the flanks, and pale red bands on the legs and chelæ. The fingers have blackish tips and inner edges; the dactylus is crossed by a pale band; the proximal half is red above.

Measurements.

		Carapace			Front	Chelæ		
No.	Sex	length	br'dth total	br'dth —spines	bet'wn orbits	length	height —spine	Locality
692 F. M.	♂	27	41	36	12	r. 35	r. 12.5	Bermuda
——	♂	21	31.2	—	—	l. 33.5	l. 10	Porto Rico

The type described by Stimpson* was only .20 of an inch in length; total breadth, .31; breadth minus spines, .25; ratio of length to latter breadth, 1:1.25.

The second, given in the above table, is that measured by Miss Rathbun, from Porto Rico. The ratio of length to breadth decreases with growth.

Our specimen, as stated above, differs from the smaller ones. According to Stimpson his had the front more prominent and the two middle teeth were "smaller and more prominent, and separated from the lateral ones by a rather broad and shallow sinus." This inequality is not so evident in ours. He says there is no notch in the inner orbital tooth. It was present in Miss Rathbun's specimens, and she considers its absence due to immaturity. In Stimpson's type "the inner spine of the carpus is long, reaching to the middle of the palm of the hand." It is much shorter in the Bermuda specimen. Probably this is a character only of the very young.

* Dr. Stimpson's types of Crustacea were all burned in the great Chicago fire.

Stimpson did not notice the alternation of smaller and larger marginal teeth, but that condition was described by Miss Rathbun. Notwithstanding these and other differences I do not doubt the identity of the Bermuda example.

The only Bermuda specimen known to me was taken Sept. 30, 1905, at Long Bird Island (probably in a fish seine), by the expedition from the Field Natural History Museum.

Stimpson's types were from off the Florida Reefs in 37 to 40 fathoms (Pourtalès coll.). Porto Rico, four stations (Rathbun). Bahia, Brazil (Miers).

Doubtful Species.

According to M. Walter Faxon there is in the Museum of Comparative Zoology, Cambridge, Mass., a specimen of *Cancer borealis* Stimpson, labelled as from Bermuda.

My belief is that its label is erroneous, or has been accidentally transposed. It is a large northern species, common at low tide on some of the rocky shores of Casco Bay, Me., and ranging southward in the deeper water of the arctic current as far as off Cape Hatteras.

Boscia ?, sp.

Willem.-Suhm states that he collected a species in Bermuda "allied to *Boscia*." No such species was mentioned in the final report by Miers. To what he refers is problematical. *Boscia* is a fresh-water genus (= *Pseudothelphusa*). See Bibliography, below.

Libinia emarginata Leach = *L. canaliculata*.

This species is recorded by Hurdis (Rough Notes, p. 361), without any notes. It has not been found by anyone else. Probably his identification was erroneous. It is common from Cape Cod to Florida.

Figure 37.—Deformed claw of an undetermined cancroid crab, from the collection of J. M. Jones, but without a special label. Supposed to be from Bermuda, × $1\frac{3}{5}$.

OXYRHYNCHA = MAIOIDEA. (See p. 305.)

Family **INACHIDÆ**. *Spider Crabs.*

Basal joint of antennæ narrow. Orbits incomplete, sometimes absent; eyes not completely retractile. Chelipeds feeble; legs often long; rostrum well developed.

Stenorhynchus sagittarius (Fabr.). Rathbun.

Cancer sagittarius Fabr., Ent. Syst., ii, 442, 1793.

Maia sagittaria Bosc, Hist. Crust., ii, p. 253, 1801. Latreille, Gen. Crust., i, p. 38, 1806.

Leptopodia sagittaria Leach, Zoöl. Miscell., ii, p. 16, pl. lxvii, 1815. Latreille, Encycl. Meth., Insects, pl. 299, fig. 1, 1818. Desm., Consid. Crust., p. 155, pl. xvi, fig. 2, 1825. Latr. in R. Anim., Cuvier, ed. ii, p. 64, 1829. Guerin, Iconog. Reg. Anim., pl. ii, fig. 4. Von Martens, Cuban Crust., Arch. Naturg., p. 79, 1872. Smith, Ann. Rep. U. S. Fish Com. for 1885, p. 16. H. Milne-Edw., Hist. nat. Crust., i, p. 276, 1874; Atlas, reg. anim., Cuv., Crust., pl. xxxvi, fig. 1. A. M.-Edw., Mission Sci. Mex., part v, vol. i, p. 172, 1878; Bull. Mus. Comp. Zoöl., viii, p. 6, 1880. M. J. Rathbun, Proc. U. S. Nat. Mus., xvii, p. 44, 1895 (distr.).

Leptopodia ornata Guilding, W. Ind. Crust., Trans. Linn. Soc., p. 335, 1825 (*t.* Edw.).

Leptopodia lanceolata Brullé, Hist. Nat. Canaries, Crust., fig. 1, 1844 (*t.* Edw.).

Stenorhynchus sagittarius M. J. Rathbun, Ann. Inst. Jamaica, i, p. 4, 1897; Decapod Crust. West Africa, Proc. U. S. Nat. Mus., xxii, p. 293, 1900; Brach. and Macr. Porto Rico, p. 53, 1901. Verrill, these Trans., vol. x, p. 577, 1900 (Bermuda).

Plate XXII, Figures 1–1*d*.

A specimen of this species was contained in the local collection of the late J. T. Bartram, of St. Georges. While Mr. Goode was in Bermuda, 1877, he made a drawing of Mr. Bartram's specimen and sent it to Professor S. I. Smith for identification. There is no other Bermuda record. Probably the specimen referred to was obtained through the deep-water fisheries or in lobster-pots.

Its range is from Cape Hatteras to Florida and throughout the West Indies, to Rio Janeiro, Brazil; Madeira; Cape Verde; and Canary Is.; Mediterranean and West Africa.

Off Cape Hatteras, 11–27 fathoms, Albatross dredgings, 1885 (Smith). West Indies, Blake Exp., dredged in 27–115 fathoms. West Indies, Albatross dredgings, 9–130 fath. (Rathbun). Dominica Island, 100–140 fathoms (A. H. Verrill, 1906, Yale Univ. Mus.). Porto Rico, 6–76 fathoms (Rathbun). It has been recorded from 2 to 814 fathoms.

Podochela Riisei Stimp.

Podochela (*Podonema*) *Riisei* Stimp., Ann. Lyc. Nat. Hist. N. York, vii, pp. 196, 197, pl. ii, fig. 6, 1860 (descr.); Bull. Mus. Comp. Zoöl., ii, p. 126, 1870.

Podochela Reisei A. Milne-Edw., Crust. Miss. Sci. Mex., v, p. 193, pl. xxxiv, fig. 1, 1879.

Podochela Riisei Miers, Voy. Challenger, Zoöl., xvii, p. 11, 1886. Smith, Ann. Rep. U. S. Fish Comm. for 1885, p. 16, 1886. M. J. Rathbun, Proc. U. S. Nat. Mus., xvii, p. 48, 1895 (distr.); Amer. Naturalist, xxxiv, p. 508, fig. 1, 1900; Brach. and Macr. Porto Rico, p. 54 (descr.).

Corynhynchus Riisei Kings., Amer. Nat., xiii, p. 585, 1879; Proc. Acad. Nat. Sci. Philad., xxxi, p. 384, 1879.

Plate XXII, Figure 2.

This species has been taken at Bermuda only by the Challenger Expedition, by which it was dredged in shallow water. It is rarely obtained except by dredging.

Bermuda (Miers, Chall. Exped.). Off Cape Hatteras, 13–49 fath. (Smith, 1886). West Indies to Pernambuco, Brazil. St. Thomas and Tortugas (Stimpson). Gulf of Mexico and Caribbean Sea, 3–30 fath. (Rathbun). Bahia Honda, Cuba, on wharf (Rathbun). Key West and Sarasota Bay, Fla. (Kingsley). Off Pernambuco, 30+ fathoms (Miers).

Chorinus heros (Herbst) Latr.

Cancer heros Herbst, Krabben und Krebse, ii, p. 165, pl. xlii, fig. 1; pl. xviii, fig. 102, 1796.

Chorinus heros Leach, Mss., in Latreille, Encyc. Meth., x, p. 139, 1825. M.-Edw., in Cuvier, Illust. ed., Crust., p. 85, pl. xxix, fig. 2. A. M.-Edw., Miss. Sci. Mex., part v, vol. i, p. 86, 1873. Von Martens, Arch. für Naturg., xxxviii, p. 80, pl. iv, fig. 2 (Cuba). Kingsley, Proc. Acad. Nat. Sci. Philad. for 1879, p. 385 (measurements, Florida specimens). M. J. Rathbun, Proc. U. S. Nat. Mus., xvii, p. 65, 1894; Brach. and Macr. Porto Rico, p. 61, 1901 (descr.).

Plate XXIV, Figure 3.

This appears to be a very rare species at the Bermudas, at least in shallow water. It probably inhabits the rough bottoms off the reefs. The only Bermuda specimen known is a carapace, found on the beach (coll. J. M. Jones, Yale Mus., No. 3126).

Its range extends from Florida to Bahia, Brazil. Off Florida, 12 fath. (Stimpson). Key West (Gibbes). Barbados and Martinique (M.-Edw.). Bahia (Rathbun). Porto Rico, 9½ to 16 fath. (Rathbun).

Epialtus bituberculatus (M.-Edw.) var. **bermudensis** Ver.

Epialtus bituberculatus H. M.-Edw., Hist. nat. Crust., i, p. 345, pl. xv, fig. 11, 1834. A. M.-Edw., Miss. Sci. Mex., Crust., p. 139, pl. xxvii, figs. 1-3, 1878. M. J. Rathbun, Proc. U. S. Nat. Mus., xvii, p. 67, 1895 (distrib.); Brach. and Macr. Porto Rico, p. 60, 1901.

Epialtus sulcirostris and *E. longirostris* Stimpson, Ann. Lyc. Nat. Hist., vii, pp. 198, 199, 1860; A. M.-Edw., op. cit., p. 141, pl. xxvii, figs. 5, 6.

Epialtus dilatatus A. M.-Edw., op. cit., p. 140, pl. xxvii, fig. 4, 1878 (*t.* M. J. Rathbun).

Epialtus bituberculatus, var. *bermudensis* Verrill, these Trans., xi, p. 16, pl. i, fig. 1, 1907 (descr.).

Plate XXIV, Figure 1.

A single specimen (see figure) taken by A. H. Verrill, March, 1901, is the only one known from Bermuda. It was found in a small cavity in a ledge, between tides. The entrance to the cavity was so small that the stone had to be cut away with a chisel before the crab could be extracted. That specimen is fully described in the place quoted above. The species has a wide range, with several local varieties or races. It extends from Indian River, Fla., to Rio Janeiro, Brazil. Egmont Key, West Florida (Yale Mus.). The West Coast form ranges from Southern California to Chili (var. *minimus* Lockington).

Family **Pericerida** (=**Maiidæ**,* some authors). *Spider Crabs.*

Basal joint of the antennæ well developed, inserted beneath the eyes, and usually forming a large part of the inferior boundary of the orbits. Chelipeds not of unusual size, often not much larger than the other legs. Orbits complete; eyes retractile.

This family, as here understood, includes several groups that have been regarded as subfamilies, or even families : *Pericerinæ*, *Mithracinæ*, *Orthoninæ*, *Paramayinæ*, etc.

Probably many more species of this family than are here recorded inhabit the rough bottoms at moderate depths around the outer reefs.

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* The generic name *Maia*, as shown by Miss Rathbun, cannot be used for a genus of this group. Therefore this family name should also be changed.

More recently (1905) Miss Rathbun has stated that *Paramaya* de Haan, 1837, is identical and should have priority.

Mamaiidæ Stebbing (S. African Crust., Part iii, p. 22, 1905) has been proposed for the group here regarded as a subfamily, *Paramayinæ*.

Mithrax (including *Mithraculus*).

Analytical Key to the Bermuda Species of Mithrax and some allied species
(Modified from that of Miss Rathbun).

A. Carapace without oblique, parallel, branchial grooves.
B. Manus of chelipeds spinulose. Carapace with conical spines; not setose.
a, Two distal segments of ambulatory legs stout, very setose; spines of manus in one dorsal row ..... *spinosissimus*
a', Two distal segments of ambulatory legs long and slender, sparsely hairy. Spines of manus in two dorsal rows ..... *cornutus*
B'. Manus smooth, without spinules.
C. Rostral horns short, blunt or tuberculiform.
D. Spines or tubercles of antero-lateral margin four, behind orbitals, simple or bifid: basal joint of antennæ with inner tooth longest.
E. Carapace not multi-tuberculate; carpus often nearly smooth; merus of chelipeds multispinose; basal joint of antennæ narrow, with two denticles *hispidus*
E'. Carapace and carpus of chelipeds tuberculate; merus spinose; rostral horns about as long as broad, obtuse: basal joint of antennæ wider, with two acute spines ..... (*depressus*)
C'. Rostral horns long and slender ..... *acuticornis*
A'. Carapace with oblique, parallel, branchial grooves; antero-lateral margins with four acute spines; carapace broader than long in adults *forceps* (*hirtipes*)

Mithrax cornutus Saussure. *Coral Crab, Red Spider Crab.*

Mithrax cornutus Saussure, Mem. Crust. nouv. Mex. et Antilles, p. 7, 1858. A. M.-Edw., Miss. Sci. Mex., v, i, p. 97, pl. xxii, 1875.

Figure 38.

This species grows to rather large size in the West Indies. The only Bermuda specimen known is young.

It closely resembles *M. spinosissimus* of the West Indies* in the form and spinulation of the carapace and chelæ, but it can easily be distinguished by the longer and more slender chelipeds and legs, and especially by the far more slender distal two segments of the ambulatory legs, which are nearly destitute of spines and have only short, sparse hairs, while in the latter these segments are stout, not abruptly attenuated, and are thickly covered with strong dark colored hairs.

In both species the merus and carpus of the chelipeds are covered with numerous strong and acute curved spines; in this species the merus is longer and has about eight or nine very acute spines on the posterior border, and near them another irregular row of nearly the

* This species is likely to occur on the rough grounds outside the Bermuda reefs. Hence I have given the most obvious distinctions here.

same number and size on the upper surface; numerous smaller unequal conical spines are scattered on the upper surface or form broken rows, while the anterior margin bears a row of about five or six obtuse spines, much smaller than those of the other margin; there is also a row of three or four still smaller ones on the under side.

In *M. spinosissimus* the spines of the merus are not so numerous, but larger, longer, more equal, more curved and very acute and bear rough, divergent stiff hairs; about ten to twelve large, nearly equal spines stand on the posterior border; two or three large and some small ones on the anterior border; the upper surface bears about six large spines and a few very small ones; the largest are distally situated and some of them are larger than the marginal ones; there

Figure 38.—*Mithrax cornutus*, from Bermuda; young with eggs, about $\frac{7}{8}$ nat. size. Phot. A. H. V.

is a row of about three short spines on the under side; the carpus is also covered with numerous (about twenty-five to thirty) very unequal, very acute, divergent spines, some on the inner edge as large as those of the merus.

In *M. cornutus* the carpus bears rather more numerous spines, but they are mostly smaller and less acute, more than half of them being mere conical tubercles.

The manus in this species bears two distinct rows of eight to ten spines on the upper edge, which is not much compressed; these spines are short and obtuse.

In *M. spinosissimus* the dorsal spines of the manus, of which there are about eight to ten, form a single zigzag row; they are also longer and usually more acute, but in large specimens often become blunt. The dorsal part of the manus is strongly compressed.

The frontal horns in *cornutus* are rather larger and straighter than in the other, and the subrostral process, between the antennulæ, is narrow and directed strongly backward, while in the other it is wider, thick, and nearly perpendicular, with an acute, excurved tip.

The buccal area has the anterior, lateral sinuses more strongly arched in *M. cornutus*, and the corresponding parts of the outer maxillipeds are, therefore, more convex.

There are other distinctions that might be noticed, but the wide difference in the tips of the legs is the most convenient diagnostic character.

In *M. cornutus* the ratio of the proximal vertical diameter of the propodus of first pair of ambulatory legs to its length is 1:4.5 to 1:5; of the dactylus, 1:6. In *M. spinosissimus* the corresponding ratios are 1:3 and 1:4.

The propodus in the latter is strongly compressed and decidedly tapered, but in *M. cornutus* it is scarcely compressed, and not tapered, the distal end being larger than the middle and about equal to the proximal end; its dactylus is also less curved and the tip very slender.

The color of *M. cornutus* in life is bright red above, lighter below; when recently dried it soon changes to pale red, yellowish red, or terra-cotta color, by exposure to light.

Measurements.

		Carapace				Chelæ		
	Sex	total length	length —rostum	breadth total	breadth —spines	length	height	
4069	♂	64	58	62	53	46	13	Dominica
453 F.M.	♀ eggs	29	26	25.5	22	14	4	Bermuda
4070	♀ eggs	68	59	60	52	33	8	Dominica

In No. 4069 the merus of chelipeds is 35^{mm} long; greatest thickness, without spines, 9^{mm}; merus of first amb. leg, 28^{mm}; thickness in middle, 6^{mm}; its propodus, length, 21^{mm}; thickness, 4.5; dactylus, 18^{mm}; proximal diameter, 3^{mm}.

M.-Edwards gives for his largest (♂) specimen: length of carapace, 92^{mm}; breadth, 90^{mm}; length of chela, 82^{mm}.

The only specimen known from Bermuda (453 F. M.) was taken October 12, 1905, in 30 fathoms on the Challenger Bank, by the expedition from the Field Museum of Natural History. It is a small and evidently young female, but it carried a considerable mass of eggs.

At Dominica Island, in 1906, Mr. A. H. Verrill obtained a number of much larger perfect specimens, taken in fish-pots, in rather deep water (40–150 fathoms) where it was associated with *M. spinosissimus*, of very large size, and other large spider crabs.

It is a comparatively rare species, recorded by few authors. A. M.-Edwards knew only two specimens, from Martinique, in the Paris Museum. It was not mentioned by Stimpson, nor was it in the Porto Rico collection, studied by Miss Rathbun. It was not represented in the large collections of the National Museum enumerated by her in 1892.

Mithrax (Nemausa) acuticornis (Stimpson).

Mithrax acuticornis Stimpson, Bull. Mus. Comp. Zoöl., ii, p. 116, 1870. A. M.-Edw., Miss. Sci. Mex., v, p. 98, 1875. M. J. Rathbun, Amer. Naturalist, xxiv, p. 512, fig. 8, 1900.

Nemausa rostrata A. M.-Edw., Miss. Sci. Mex., Part v, i, p. 81, pl. xvii, figs. 4–4*d*, 1875. Miers, Voy. Challenger, Zoöl., p. 85, 1886 (Bermuda).

Mithrax (Nemausa) acuticornis M. J. Rathbun, Proc. U. S. Nat. Mus., xv, p. 260, pl. xxxvii, fig. 1, 1892; Bull. Labr. Nat. Hist. Univ. Iowa, iv, p. 259, 1898. Brach. and Macr. Porto Rico, p. 66, 1901.

FIGURE 39.

This species is characterized by its elongated and narrow carapace, the sharp lateral spines, and especially the unusually long and acute rostral horns.

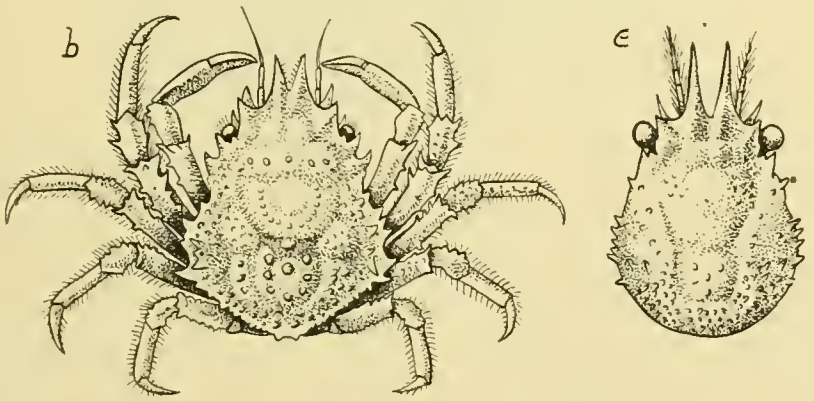

Figure 39.—*Mithrax acuticornis*; *c*, the same, the carapace of a younger specimen, × about three times. After A. M.-Edwards.

Recorded from Bermuda by Miers (Voy. Chall.), but not obtained by later collectors. Florida, West Indies and Gulf of Mexico, shore to 164 fathoms. Off Key West, 60 fathoms (Rathbun).

Mithrax hispidus (Herbst) Edwards. *Large Red Spider-crab; Coral Crab.*

Cancer hispidus Herbst, op. cit., Band i, p. 247, tab. xviii, fig. 100, 1790.

Mithrax hispidus H. Milne-Edwards, Mag. de Zoölogie, 2e an., 1832; Hist. nat. des Crust., i, p. 322, 1834. DeKay, Zoölogy of New York, Crust., p. 4, 1844. Gibbes, op. cit., p. 172. Stimpson, Amer. Jour. Sci., 2d ser., xxix, 1860, p. 132; Annals Lyc. Nat. Hist., New York, vol. vii, p. 18, 1860. Smith, these Trans., ii, pp. 2, 32, 1869 (descr. and measurements, Brazil). A. M.-Edw., Miss. Sci. Mex., v, i, p. 93, 1873, pl. xxi, fig. 1, 1875. M. J. Rathbun, Proc. U. S. Nat. Mus., xv, p. 265, 1892 (synon. and distribution); Brach. and Macr. Porto Rico, p. 67, 1901.

Maia spinicincta Lam., Hist., v, p. 241, 1818.

Figure 40. Plate XXIII, Figures 3, 4. Plate XXIV, Figure 1.

This species grows to large size. In life the larger specimens are nearly uniform deep brownish red or terra-cotta color above, brighter on the chelipeds and darker on the legs (due to brown hairs). The legs often have brighter red bands at the joints. Under parts of body mostly white or bluish white; legs red, specked with pale yellow.

Figure 40.—*Mithrax hispidus*, young ♀, from Bermuda, about $\frac{4}{5}$ nat. size. Phot. A. H. V.

A young specimen (No. 4058, fig. 40) in life had bright colors: the carapace was bright reddish brown, varied with paler patches; the spines and tubercles were light brown; chelæ pink with fine black spots; legs red, banded with pale yellow; ventral parts pale blue and bluish white. (C. S. V.)

In large individuals the gastric area is prominent, wide, with convex sides and defined by a wide and deep groove; the groove bounding the cardiac area is wide, but shallower.

Our larger Bermuda specimen has many unequal conical spines and tubercles on the surface, but between them the surface is smooth

and finely punctate, without granules. The arrangement of the spines is sufficiently well shown by the figures. The posterior lateral spine is simple, very acute, hooked, with the point turned upward and forward ; the next, which is the largest and least curved, has three to five small spinules on its base ; the next, which is nearly as large and more strongly hooked forward, is very acute and has one or two small basal spinules ; the next (or second behind the orbitals) is larger and swollen at base, strongly hooked forward and acute at tip, and bears an acute spinule on its anterior base, and a cluster of about three small tubercles on the swollen upper side of its base ; sometimes it appears bifid at base. The next spine in front is usually blunt and tuberculiform, with one or two smaller rounded tubercles on its swollen base, or the two larger tubercles may be subequal. Below the latter, on the subhepatic region, there are two large prominent, unequal spines near together. An irregular row of smaller spines is situated lower down.

The orbit is surrounded by six unequal spines, besides the antennal; of these the inner (preorbital) and outer are about equal, tuberculiform and obtuse ; the two superior are small rounded tubercles. The larger antennal spine, which exceeds the rostrals in length, is acute, with tips curved mediad; the smaller antennal is also acute and about equals the inner orbitals in size and length, and it has a small rounded tubercle or tooth at its outer base.

The subrostral process is rather broad, a little concave in front, obtuse, and descends nearly perpendicularly from the rostrum. The buccal area has an angular sinus on each side of the front edge.

The ambulatory legs are covered above with sharp spines, except on the dactylus ; the spines are in two or three rows. There is also a row of five or six acute spines on the lower anterior border of the merus of the two anterior legs ; two or three spines on the third, and none on the last leg, below. The ambulatory legs are covered above, between the spines, with unequal sharp hairs which are most abundant on the dactyls, which have naked horn-colored tips.

The chelipeds, especially of the larger males, are unequal, large and strong. In the female they are equal. The merus bears two large, unequal, stout, subacute spines on the front margin, the distal one the longer and more curved ; the upper surface has about ten unequal conical spines irregularly arranged (four or five in younger specimens); the posterior border has a row of about five to seven longer conical, subacute spines, sometimes with a few small ones interpolated. The carpus is large and swollen, punctate, nearly

smooth, but faint indications of three to five nearly obsolete tubercles can usually be seen, and in some cases two or three small proximal ones are fairly distinct. The manus is strongly compressed above, proximally, with a large round articular tubercle, but smooth, with no indication of spines or granules.

Measurements of M. hispidus and M.? depressus.

		Carapace				Chelæ		
No.	Sex	length, total	breadth, total	—spines	Bet. orbits	length	height	Manus above
3019	♂	8.5	9	8.5	4	5.5	2	3.5
3265	♀	20	22.5	---	12	14	4	---
1810	♀	23	27	24	8.5	17.5	5	10
4054	♀	29	34	31	9	22	6	13
1753	♂	29.5	35	31	---	23	7	13
4058	♀	69	87	73	---	60	17	33.5
868 F.	♂	67	86	74	16	r. 57 l. 61	17 r. 18 l.	32 r. 35 l.
34	♂	87	115	100	---	60	36	---

Nos. 3019, 4054, 4058, 868 F. Mus., and 34 are from Bermuda; No. 3265, from St. Thomas; No. 1810, East Mexico; No. 1753, Key West, Fla.

Nos. 34 and 1753 were measured by Prof. S. I. Smith. No. 34, from Goode's Bermuda collection, I have not examined.

Nos. 3019, 2265, 1810 are those referred, more or less doubtfully, to *M. depressus.*

Proportions of M. hispidus and M.? depressus.

Catalogue number	3019	3265	1810	4054	1753	4058	868F.M.	34
Sex	♂	♀	♀	♀	♂	♀	♂	?
Length carapace	8.5	20	23	29	29.5	69	76	87
Length to breadth	1:1.06	1:1.12	1:1.17	1:1.17	1:1.18	1:1.26	1:1.28	1:1.32
Length to breadth minus spines	1:1.0	....	1:1.04	1:1.07	1:1.05	1:1.07	1:1.10	1:1.15
Locality	Berm.	St. Th.	Mex.	Berm.	Key W.	Berm.	Berm.	Berm.

The two first in this series (No. 3265 and 4054, Yale Mus.) were labelled as *M. depressus* by Miss Rathbun. Nos. 3019, 3265, 4054, and 4058 are figured on plate xxiii.

This fine species is rare at Bermuda, at least in shallow water. It has not been found in many of the collections made there. The largest Bermuda specimen known to me was obtained by Mr. Goode (No. 34) in 1887. It was probably taken outside the reefs in fish-traps. My Yale party took a small one in 1898, and a larger one

(No. 4058) 1901, both in shallow water. The party from the Field Nat. Hist. Mus., 1905, obtained a larger and perfect specimen from off Tuckerstown point. Probably it was taken in a fish seine.

Very likely it is common in deeper water, on rough bottoms, among and outside the outer reefs, where it can be taken only in baited fish-traps. It appears to be one of the species that the fishermen call "coral crabs," probably on account of its red color.

It is commonly taken, of large size, in the West Indies, on similar rough bottoms, in five to thirty fathoms, in fish-traps. It is sluggish in its motions.

It ranges from S. Carolina to the Abrolhos Islands, Brazil (Smith). S. Carolina (Gibbes); Florida (Stimpson); Abrolhos Is., 30 fath., and off Cape St. Roque, 20 fath. (M. J. Rathbun).

Mithrax depressus A. M.-Edw. *Spider Crab.*

? *Mithrax depressus* A. Milne-Edw., Mission Sci., Mexico, part v, i, p. 96, pl. xx, figs. 4–4*d*, 1875. (Guadeloupe.) Verrill, these Trans., vol. x, p. 577, 1900 (Bermuda). M. J. Rathbun, Brach. and Macr. Porto Rico, p. 68, 1901.

FIGURE 41. PLATE XXIII, FIGURES 1 ?, 2.

The only Bermuda record of this species is based on a very young ♂ specimen (No. 3019, see pl. xxiii, fig. 1) taken in April, 1898.* It has the carapace only 8.5^{mm} long by 9^{mm} broad.

It agrees closely in spinulation with the larger specimens of *M. hispidus*, but the dorsal spinules appear sharper. All the marginal spinules are simple and acute, with the points turned forward. The basal joint of the antennæ has a long, acute, central tooth, with the tips slightly incurved, as in the larger ones, and also a smaller outer acute tooth. The carpus of the chelipeds bears several small tubercles; the merus has one small spine on the inner edge; others above.

The carapace is yellowish white, with blotches of bright red; the two largest spots of red are over the branchial areas; a median is on the cardiac area; a pair is situated farther back; another small pair is behind the orbits; and another underneath the orbits; legs yellowish white, blotched or barred with red; chelæ light red with pale tips.

Although this young specimen differs from the larger ones of *M. hispidus* in proportions and general appearance, the details of the spinulation, etc., are the same. It does not agree well with the figures of *M. depressus* given by A. M.-Edwards. There are, how-

* This is the specimen recorded by me in 1900, as *M. depressus*, on the authority of Miss Rathbun, who had examined it.

ever, specimens of intermediate sizes, that seem to unite the two supposed species together in one series.

Although this specimen appears to me to be the young of *M. hispidus*, I have kept it under *M. depressus* out of deference to the opinion of Miss Rathbun, who has examined it, for she has had opportunities to study a far larger series of both forms than I have had.

It differs from the original figure of *M. depressus* (see our fig. 34), not only in its proportions, but especially in having all the four antero-lateral marginal teeth acute and curved forward, while in the latter the anterior three are tuberculiform and obtuse. Its front is narrower between the orbits. The basal antennal joint has the

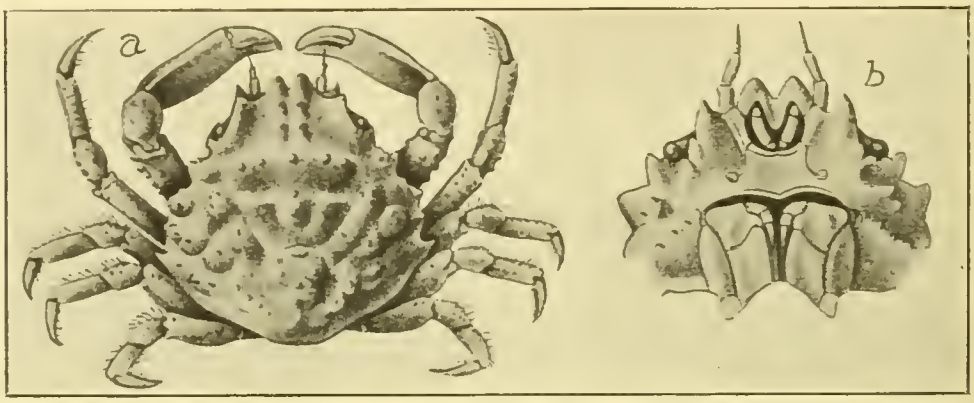

Figure 41.—*Mithrax depressus; a*, dorsal view, × 2⅓ times; *b*, under side of front, more enlarged. After A. M.-Edwards' original figures. According to the natural size diagram of Edwards, his specimen was 13mm long and 12mm wide.

inner tooth narrower and sharper, and the outer one more prominent and acute. The merus of the chelipeds has a different form, the proximal end being concave instead of convex, etc. It is rather smaller than Edwards' type, which was also young, but longer than wide, while ours is wider than long.

On plate xxiii, fig. 2, I have figured a St. Thomas specimen of larger size, also labelled as *M. depressus* by Miss Rathbun, for comparison. This is rather larger than Edwards' type and agrees more nearly with his figure in respect to the form of the marginal teeth, but is otherwise very similar to the undoubted young of *M. hispidus*. The carpus of the young of the latter is also spinulous.

The larger antennal tooth is shorter and more obtuse than in any of the others figured.

From the east coast of Mexico, near Vera Cruz, we have a specimen (No. 1810 ♀ Yale Mus.) which agrees very closely with Edwards' figure of *M. depressus* as to the tubercles of the carapace and the marginal spines, and also as to the teeth of the basal antennal joint. But the merus of the maxillipeds is concave proximally, as in our other specimens. In this, the most posterior (4th) marginal tooth is very acute and hooked forward, but the other three are short-tuberculiform or broad obtuse-conical, with coarse granules on their bases; the more anterior are the larger, as in Edwards' figure. The tubercles of the carapace are broadly rounded or flattened, which is the case in *depressus*.

The merus of the chelipeds has a single obtuse spine on the inner edge; five on the outer, and two on the upper surface. The carpus is angular and uneven, with a distal transverse fossa and about nine unequal rounded tubercles.

This approaches the type of *M. depressus* more nearly than any other that I have seen. It has the adult form of the female abdomen, while number 4558 (*M. hispidus*), which is considerably larger, has the immature form of the abdomen. It is, however, very unlike the small Bermuda specimen, described above.

The range of *M. depressus* is from Florida to the Abrolhos Islands, Brazil (t. M. J. Rathbun). East coast of Mexico (Yale Mus.).

Mithrax forceps (M.-Edw.) sub-sp. **hirsutipes** Kings. *Common Spider Crab.*

? *Mithraculus forceps* A. M.-Edw., Exp. Sci. Mex. Crust., i, p. 109, pl. xxiii, fig. 1, Dec., 1875 (t. Miers).

Mithrax hirsutipes Kingsley, Proc. Boston Soc. Nat. Hist., xx, p. 147, 1879 (descr.); Proc. Acad. Nat. Sci., Philad., p. 389, pl. xiv, figs. 1, 1*a*, 1879 (measur.) Rankin, Crust. Berm., p. 532, 1900.

Mithrax forceps Miers, Rep. Voy. Chall., xvii, pp. 87, 88, 1886. Rathbun, Bull. Labr. Nat. Hist., Univ. Iowa, 1898, p. 260 (Bahamas and Florida).

Mithrax forceps Rathbun, Proc. U. S. Nat. Mus., xv, p. 269, 1892 (descr., synon., and distribution); Brach. and Macrura Porto Rico, p. 70, 1901.

Figure 42. Plate XXIII, Figures 4, 5, 6.

This species is easily distinguishable, from the others found at Bermuda, by the three strongly marked oblique ridges and intervening wide grooves on the branchial areas of the carapace. The last of these is more or less broken up and nodular; the two anterior are stronger and smoother, but often bear small tubercles. Two pairs of small tubercles are situated behind the rostral teeth, but there are no tubercles on the median line, and no transverse row on the gastric

area. The four antero-lateral spines are usually all similar in size, simple, and mostly acute and curved forward, but the anterior one is often a little shorter than the 2d and rather obtuse; the 2d and 3d are always acute, with the tips bent forward; the 4th is often smaller and more conical and less acute. The surface of the carapace and chelipeds is polished and shining, with no indications of hairs or granulus.

The chelipeds of the adult males are relatively large and strong, subequal, with the claws gaping. The dactyl is curved, denticulate only distally, with a strongly excavate tip, and it bears a strong tooth about the middle; the thumb has a broader denticulate tooth toward the base. In the young these teeth are absent.

Figure 42.—*Mithrax forceps, hirsutipes*, adult male from Bermuda, under side, about nat. size. Phot. A. H. Verrill.

The carpus and chelæ are smooth, with no tubercles except a small denticle on the inside edge of the carpus; the merus bears two large acute spines on the inner margin, and about 4 or 5 much smaller, obtuse ones on the outer margin; the upper surface may have a few minute ones, or in adults a row of two or three obtuse ones. The ambulatory legs are rough with small short spines and long unequal stiff hairs; the dactyls are strong, incurved, with sharp tips; there is a prominent articular plate at the superior distal end of the propodus.

The basal antennal plate is wide and thick, tridentate; the outer tooth, which is much the largest, is broad and obtuse, its base occupying about half the width of the plate; the next is not more than half as large and subacute; it is separated from the still smaller

inner one by the notch for the base of the flagellum ; the inner one is inconspicuous and often abortive. The notch between the two larger teeth is broadly concave. The outer tooth is just about the same length and size as the preocular tooth, but is more obtuse. The rostral teeth are short and obtuse, with thickened and slightly upturned edges in the adults. The subrostral process is large, concave, and obtuse.

Young specimens differ much from the adults in appearance. The oblique ridges of the carapace are all more broken up into nodules and tubercles, and the whole surface of the carapace is more nodose, so that it resembles that of *M. sculptus* in this respect, but the latter can easily be distinguished by the tuberculiform lateral teeth, roughened carpus, and other characters. The carapace of the young is also longer in proportion to the breadth (1 : 1.12 to 1 : 1.15).

Specimens recently preserved in alcohol and not much altered are mostly light yellowish brown or chestnut-color, varying in the same lot to orange and to purplish brown.

In life the carapace is usually uniform yellowish brown, varying to dull yellow and to greenish brown, without mottlings. Often there is a wide, pale yellow, medial dorsal stripe, especially in the young. Large males are sometimes plain chestnut or terra-cotta color. In the young the legs are often banded with lighter colors.

Females carrying abundant eggs were often taken in April and May, 1898 and 1901. A large female, taken in midsummer by Prof. Kincaid, also carried eggs. This crab is often captured by the large *Octopus*.

Measurements of Bermuda specimens.

		Carapace			Front	Chelæ		
No.	Sex	length total	breadth total	breadth —spines	bet. orbits	length total	manus above	height
3169	♂	22	26	24.5	9	25	13	10
3169*a*	♂	25	31	28	10	28	14	13
3169*b*	♂	19	21.5	20	8	19	11	9
718	♂	23	28	26	9	27	14	10.5

The ratios of length to total breadth in the above are 1 : 1.18, 1 : 1.24, 1 : 1.13, 1 : 1.22 respectively.

The egg-bearing females, taken in April and May, can be grouped in three pretty distinct sizes, though some intermediate ones occurred. The larger ones averaged in length of carapace, about 16^{mm}; breadth, 18^{mm}; those in the next smaller series average about 13^{mm} long; 15^{mm} wide; the smallest group, about 11^{mm} long; 12.5^{mm} wide. The

smallest individual with eggs is 10^{mm} long, 11.5^{mm} wide. Some of the eggs contain well developed young, about ready to hatch.

Dr. Stimpson failed to recognize this common species among the large W. Indian collections that he studied. He probably confused it with *M. sculptus*, which is closely allied.

Although several recent writers identify this species with *M. forceps* M.-Edw. (from S. America), it must be admitted that it does not agree with his figure and description. However, I have examined Brazilian specimens agreeing well with those from Bermuda. But two similar species may occur there.

Edwards does not describe his species as having strong, oblique branchial ridges and grooves, though they are, perhaps, faintly indicated in his figure. He says that the surface of the carapace is scarcely nodular, some tuberculiform elevations showing only near the branchial regions.

The carapace, as stated by him, is proportionately the same as ours (length, 30^{mm}; breadth, 35^{mm}; ratio 1:1.17; in our larger males it is from 1:1.18 to 1:1.24. The form of the merus of the maxillipeds is quite unlike our species, and the same is true of the basal joint of the antennæ. Unless his figures and description were very incorrect, in all these and other respects, it would be unreasonable to consider them identical, for the allied species do not vary to any such extent in these important characters. Of the present species I have had more than a hundred specimens, of all sizes, for comparison. Although the young differ considerably from the adults, as to areolations, they have essentially the same forms of the basal antennal plate and maxillipeds and do not approach those figured by Edwards.

The chelæ of the male, according to his description and figure, are rather long and slender, length to breadth as 3:1; while in ours, of similar size or smaller, they are much stouter, ratios about as 2:1. Moreover specimens of the present species, formerly sent to M.-Edwards by Prof. Smith, were not identified as his species by him.

Therefore I have preferred to retain *hirsutipes* (Kings.) as the name for the Bermuda and West Indian form, at least as a variety or geographical race, until Edwards' type can be reëxamined.

We found this one of the most common crabs at the Bermudas. It occurred on almost every rocky shore and reef in crevices and living under stones and dead corals, and also often exposed, between tides and in shallow water; 1–17 fathoms (Challenger coll.).

It was in the collections of Jones; Goode; the Challenger; and nearly every other later collector.

It ranges from Beaufort, N. C. to the Abrolhos Islands and Bahia, Brazil. Off Cape Fear, N. C., 15–17 fathoms, West Indies, 6–16 fathoms, Florida, and many other localities (Rathbun). Bermuda and Bahia, Brazil (Miers; Rathbun); Abrolhos (Smith, Yale Mus.).

Microphrys bicornutus (Latr.) A. M.-Edw. *Spider Crab.*

Pisa bicornuta Latreille, Encyc. Meth., Nat. Hist., x, p. 141, 1825.

Pericera bicorna H. Milne-Edwards, Hist. nat. Crust., i, p. 337, 1834.

Pisa bicorna Gibbes, Proc. Amer. Assoc., 3d meeting, p. 170, 1850.

Pericera bicornis Saussure, Crust. Antilles et du Mexique, p. 12, pl. 1, figs. 3, 3*c*, 1858.

Milnia bicornuta Stimpson, Notes on North Amer. Crust., Annals Lyc. Nat. Hist., New York, vol. vii, pp. 51, 180, 1860. Smith, Brazil Crust., these Trans., ii, p. 1, 1869.

Microphrys bicornutus A. Milne-Edw., Nouv. Arch. Mus. Hist. Nat., viii, p. 247, 1872; Miss. Sci. Mex., v, p. 61, pl. xiv, figs. 2–4, 1873; Bull. Mus. Comp. Zool., viii, p. 1, 1880. Miers, Voy. Chall., Zool., viii, p. 83, 1886 (Bermuda).

Microphrys bicornutus M. J. Rathbun, Proc. U. S. Nat. Mus., xv, p. 253, 1892 (synon.); Brach. and Macrura Porto Rico, p. 72, 1901.

Pisa galibica and *Pisa purpurea* Schramm and Desb., Crust. Guadeloupe, p. 18, 1867 (*t.* A. M.-Edw.).

FIGURE 43.

In life, this species nearly always has its carapace covered with closely adherent algæ, bryozoa, sponges, etc. which pretty effectually

Figure 43.—*Microphrys bicornutus*, nat. size, with foreign growths on the carapace. Phot. A. H. V.

conceal it. When cleaned, it is dull yellowish brown; its chelipeds are always covered with small, round, purplish spots. This is diagnostic for the species.

Many of the females collected April 20, 1901, carried eggs.

It is everywhere common on the rocky shores at low tide and on the reefs, living in crevices and under stones, or often more or less exposed. It is contained in nearly every Bermuda collection, including those of Jones, Goode, and others of early date.

Its range extends from Florida to Bahia, Brazil. Common on coral reefs throughout the West Indies. Abrolhos Reefs, Brazil, Colon, Florida, and Bermuda (Smith); Pernambuco (Rathbun).

Macrocœloma trispinosum (Latr.) Miers. *Spider Crab.*

Pisa trispinosa Latr., Ency. Meth., Nat. Hist., x, p. 142, 1825.

Pericera trispinosa H. Milne-Edw., Hist. nat. Crust., i, p. 336, 1834. A. M.-Edw., Miss. Sci. Mex., v, p. 52, pl. xv, fig. 2, 1873.

Macrocœloma trispinosa Miers, Journ. Linn. Soc. London, xiv, p. 665, 1879; Voy. Chall., Zoöl., xvii, p. 80, 1886. M. J. Rathbun, Proc. U. S. Nat. Mus., xv, p, 249, 1892 (syn. and distribution); Brachy. and Macr. Porto Rico, p. 74, 1901.

FIGURE 44.

This is one of the more common crabs at the Bermudas. It occurs from low water to 10 fathoms and more. It is very slow in its

Figure 44.—*Macrocœloma trispinosum*, with the hairs, etc., removed from the left side of the carapace; about nat. size. Phot. A. H. V.

motions and for its protection depends largely on the growth of sponges, algæ, etc. which usually entirely covers the nodulose carapace, causing it to resemble a stone or a mass of sponges. When

cleaned, it is reddish brown. Some taken in April, 1898, and April 20, 1901, carried eggs; also one taken in midsummer by Prof. Kincaid. Its range extends from North Carolina to Bahia, Brazil. Dominica I. (Yale Mus., coll., A. H. Verrill).

Off N. Carolina, 17 fathoms (U. S. Fish Com.).

Macrocœloma subparallelum (Stimp.) Miers.

Pericera subparallela Stimpson, Ann. Lyc. Nat. Hist. N. York, vii, p. 182 [54], 1860 (St. Thomas); A. M.-Edw., Crust. Miss. Sci. Mex., p. 54, pl. xiii, figs. 3–3*d*, 1873. Verrill, these Trans., vol. xi, p. 17, 1901 (Bermuda).

Macrocœloma subparallela Miers, Voy. Chall., Zool., xvii, p. 79, 1886; Rathbun, Proc. U. S. Nat. Mus., xv, p. 250, 1892.

Macrocœloma subparallelum M. J. Rathbun, Brach. and Macrura Porto Rico, p. 74, 1901.

Plate XXIII, Figures 3, *a*, *c*, *d*.

The first Bermuda specimen known was a small one, taken by the Yale party, in 1898. A much larger specimen (No. 640) was taken in a seine at Nonesuch I., Sept. 3, 1905, by the party from the Field Mus. Nat. History. It is a female carrying eggs. Its carapace is 34^{mm} long, less rostrum 27.5^{mm}; 29^{mm} broad, less spines 23^{mm}; length of rostral horns 6.5^{mm}; length of chelæ, 10.5; height, 3.5^{mm}. The horns are rather long and sharp, nearly parallel, with a large U-shaped space between them. There is a row of seven stout spiniform or conical tubercles across the posterior part of the carapace; the central and two lateral are the larger. It is covered with algæ, beneath which it is provided with a coating of stiff, rough hairs, with hooked tips.

The species ranges from Florida to Brazil.

Stenocionops furcata (Olivier) Rathbun.

Cancer furcatus Olivier, Encyc. Meth., Hist. Nat., Insectes, vi, p. 174, 1791 (*t.* Rathbun).

Cancer cornudo Herbst, Natur. Krabben u. Krebse, iii, part 4, p. 6, pl. lix, f. 6, 1804.

Pericera cornudo Latreille, Cuvier's Règne Anim., ed. 2, iv, p. 59, 1829 (*t.* M.-Edw.).

Maia taurus Lamarck, Hist., v, p. 242, 1818.

Pericera cornuta Latr., Cuvier, R. Anim., 2d ed., iv, p. 58, 1831. H. M.-Edw., Hist. nat. Crust., i, p. 335, pl. xiv, *b*, figs. 4, 5, 1834. Atlas Illust. ed. Cuvier, R. Anim., Crust., pl. xxx, fig. 1. Gibbes, op. cit., p. 172, 1850. Stimpson, Notes, i, op. cit. p. 183 [55]; Bull. Mus. Comp. Zool., ii, p. 113, 1870. A. M.-Edw., Miss. Sci. Mex., v, p. 51, 1875. Hurdis, Rough Notes, p. 361 (Bermuda). Miers, Voy. Challenger, Zool., xvii, p. 76, 1886. M. J. Rathbun, Family *Periceridæ*, Proc. U. S. Nat. Mus., xv, p. 244, 1892 (descr., syn., and bathymetrical distrib.).

Stenocionops furcata M. J. Rathbun, Ann. Inst. Jamaica, i, p. 6, 1897; Brachyura and Macrura of Porto Rico, p. 73, 1901.

Chorinus armatus Randall, Journ. Acad. Nat. Sci. Philad., viii, p. 108, 1839 (*t.* M. J. R.).

Plate XXV, Figure 2.

In life the back of the carapace is closely covered with dark brown, stout hairs, many of them with hooked tips, and in most cases it is more or less concealed by foreign growths, especially sponges (see fig.). Most of the specimens taken in deep water at Dominica I. had the back, and sometimes the legs, covered with an elegantly colored sea anemone (*Calliactis tricolor*), so numerous that the edges of their bases were in close contact, but others had sponges attached to the carapace.

A good male specimen from Egmont Key, W. Florida (No. 971, Yale Mus.), has very little foreign growths on the carapace, except a few small red algæ. But there is considerable fine sand adhering between the hairs. It comes from a sandy region, and had, perhaps, recently moulted. The long hooked hairs are partly in clusters or large groups.

Measurements.

		Carapace							
		length	length	bd'th	bd'th	Chelæ			
No.	Sex	total	—horns	total	—spines	length	height	Dactyl	Locality
971	♂	115	88	84	63	88	16	30	W. Florida
4061	♂	100	76	63	49	62	10.5	21	Dominica

The total length of a cheliped, of No. 971, is 186^{mm}; merus, 74^{mm}; carpus, 25^{mm}; chela, 88^{mm}; rostral horns, 30^{mm}.

The old males sometimes become very large, having the body nearly six inches long and four wide, including the horns and spines, but most of our specimens from Dominica are about two-thirds that size.

The only Bermuda record is that given by Hurdis, but he could hardly have mistaken such a peculiar and conspicuous species. His specimen was taken in a lobster-pot.

It ranges from off Georgia to Bahia, Brazil. Gulf of Mexico and off Yucatan, seventeen stations, 21–30 fathoms (Rathbun). Bahia, Brazil (A. M.-Edw.); Dominica I., 10–150 fathoms in fish-traps (A. H. Verrill, 1906, Yale Mus.). Egmont Key, W. Florida, Santa Cruz, and east coast of Mexico (Yale Mus.).

Family **PARTHENOPIDÆ.**

Chelipeds usually much stouter and often very much longer than the legs. Basal joint of the antennæ narrow and small, situated between the front and the bottom of the orbits.

Parthenope* (*Platylambrus*) **crenulata** (Saus.).

Lambrus crenulatus Saussure, op. cit., p. 429, pl. i, figs. 4, 4*a*, 1855. Stimpson, Notes, No. ii, p. 201 [73]; Bulletin Mus. Comp. Zool. ii, p. 129 (*Platylambrus*) 1870.

Platylambrus serratus (*pars*) A. M.-Edw., op. cit., p. 156, pl. xxx, figs. 1–1*c*, 1875.

Plate XXVII, Figure 5.

Our Bermuda specimen agrees well with Saussure's description and figure, though it is much smaller. The carapace, as in his type, has an elongated, acute, lateral spine on each side. It also has the same form of rostrum, and agrees well in the tubercles and areolation of the carapace and armature of the chelipeds.

The carapace is much cut away and slightly concave behind the large lateral spine, and has no posterior lateral spines or teeth, while there are in front of the large, lateral spine six or seven small, obtuse, nearly even antero-lateral teeth or crenulations, on the evenly convex margin. Its rostrum is wide, and not constricted near the base; the tubercles of the carapace are relatively large and obtuse; five of the largest size stand in the median row, and three or four in a curved row on each side on a ridge nearly parallel with the convex, antero-lateral margin. The cervical constriction is very marked. The under edge of the chelæ has a row of minute granule-like denticles. The only remaining ambulatory leg (3d) is small, slender, and smooth. Most of the other characters are shown in the figure.

There is, on each side, a wide channel on the under side of the carapace, as in *Platylambrus* (Stimp.). Stimpson himself proposed that genus for Saussure's species and another one, similar in respect to the channels. This genus was adopted by A. M.-Edwards. He considered *crenulatus* a synonym of *P. serratus*, but his figure of the latter does not agree with our specimen.

Saussure's type was 18^{mm} in length of carapace; breadth, with spines, 24^{mm}; without spines, 19^{mm}. The Bermuda specimen is 8^{mm}

* Miss Rathbun has shown (Proc. Biolog. Soc. Wash., xvii, p. 170, 1904) that the genus *Parthenope* (Weber, 1795) was restricted by Lamarck, 1801, to the type *P. longimana* (L.), and, therefore, that *Parthenope* should replace *Lambrus* (Leach, 1814), as usually understood.

long; 9mm wide with spines; 7.5mm without spines; length of chela, 8mm; height, 3.5mm.

Saussure's specimens were from the Antilles. Off Tortugas (Stimpson).

The single small specimen, which I refer to Saussure's species, without much doubt, was dredged on the Challenger Bank by the party from the Biological Station, in 1903.

In proportions and general appearance it resembles *P. Pourtalesii*, with which it was at first thought to be identical by me and others. The latter is not a *Platylambrus*.

It differs considerably from Stimpson's original description* of *P. Pourtalesii* in the form of the rostrum, areolation, tubercles, and form of the carapace, number and character of the marginal teeth and of those on the chelipeds, etc.

The principal references to *P. Pourtalesii* are as follows:

Parthenope Pourtalesii (Stimp.).

Lambrus Pourtalesii Stimpson, Bull. Mus. Comp. Zool., ii, p. 129, 1870.

? A. M.-Edwards, Miss. Sci. Mex., v, p. 149, pl. xxx, figs. 2–2*d*. In part, M. J. Rathbun, Amer. Naturalist, xxxiv, p. 514 (fig. 11 copied from S. I. Smith's *L. Verrillii*).

? *Lambrus Verrillii* Smith, Proc. Nat. Mus., iii, p. 415, 1881; op. cit., vol. vi, p. 14, 1883; Annual Rep. U. S. Fish Comm. for 1885, p. [24], pl. ii, fig. 2, 1886.

It should be noted that the figures given by A. M.-Edwards do not agree very well with Stimpson's description.† M.-Edwards' figures show a decidedly larger number of tubercles on the carapace; more numerous lateral teeth; two, instead of one, large posterior spines; more denticles on the chelipeds; a broader rostrum. It may well be doubted whether he really had the same species, unless his figures are very incorrect or the species remarkably variable. Our specimen comes nearer to Stimpson's type, in some respects, than to M.-Edwards' figures. But it agrees much better with Saussure's figure.

Prof. S. I. Smith, in 1881, described and figured‡ a very similar form from deep water off the eastern coast of the United States, under the name of *L. Verrillii*.

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* Stimpson's types of Crustacea were destroyed in the great Chicago Fire.

† The description in Edwards' work is a mere translation of Stimpson's and does not agree with the figures.

‡ This same figure has been used by Miss Rathbun, without credit, to illustrate *L. Pourtalesii* (Amer. Natur., xxxiv, p. 515, fig. 11). She considers the two identical.

Professor Smith later (1886) noted rather wide variations in the species that he described (see Ann. Rep. U. S. Fish Comm. for 1885), and suggested that it might prove to be the same as *L. Pourtalesii.*

His figure, however, differs much from that of M.-Edwards', especially in the much more spinulose lateral and postero-lateral margins; the much less prominent tubercles on the medial line ; different areolations; and narrower front and rostrum. But the chelipeds are much more alike in both figures, than either is like those of the Bermuda form.

Stimpson's specimens were from off Florida, in 40–107 fathoms. Straits of Florida, in 95–116 fath. (M.-Edwards). Off east coast of United States (*L. Verrillii*), in 59–67 fathoms.

Figure 44*a*.—*Cycloës Bairdii, atlantica ;* ×1½. Phot. A. H. V.

OXYSTOMATA OR LEUCOSOIDEA.

Family **CALAPPIDÆ**. *Box Crabs.*

Calappa flammea (Herbst) Bosc. *Box Crab.*

Cancer flammea Herbst, op. cit., vol. ii, p. 161, pl. xl, fig. 2, 1794.

Calappa flammea Bose, Hist. nat. Crust., i, p. 185, 1802. Miers, Voy. Challenger, xvii, p. 284, pl. xxiii, figs. 1–1*b*, 1886 (synonymy). Rankin, op. cit., p. 532.

Calappa marmorata Latr., Hist. nat. Crust., v, p. 392, 1803 (*non* Fabr.). Desmarest, Consid. Crust., p. 109, 1825. H. Milne-Edw., Hist. nat. Crust., ii, p. 104, 1837. Smith, these Trans., iv, p. 263, 1880 (young at Woods Hole: deser. of megalops); Ann. Rep. U. S. Com. Fish and Fisheries for 1885, p. 31, 1886.

Calappa flammea M. J. Rathbun, Brach. and Maer. Porto Rico, p. 84, pl. ii (colored).

PLATE XXV, FIGURE 1.

This large and curious species is easily distinguished from all others by its form and colors.

The most common color variety, taken in Castle Harbor, had the ground-color of the carapace dull olive-brown, in life, streaked irregularly with many flame-shaped blotches of bright red; edges of carapace bright yellow. Distal part of chelipeds yellow, with large broad patches of dark red; digits pale red or pink. Ambulatory legs pink above; the anterior edges bright red; the posterior edges and tarsi bright yellow.

Other specimens had the carapace covered with pretty regular, round, ocellated spots, the center white, surrounded by a ring of dark red or reddish brown. Chelipeds pink, spotted with roundish spots of deep red; spines red; tips of digits yellow. Ambulatory legs purple, with the articulations and posterior edges red; tarsi yellow. Its colors appear to be nocturnally protective.

The young of this species are narrower than the older ones, as shown by the following table. The ratios of the length to breadth of the carapace increases pretty regularly from 1:1.22, up to 1:1.59 in the largest. In still younger specimens examined the ratio is even smaller than the smallest in this table.

Measurements for proportions of Carapace.

No.	Sex	Carapace length	Carapace breadth	Ratios	Locality
7676	♀	60	85	1:1.42	Jamaica
7567	♂	58	86	1:1.48	Sabanilla
	♂	73.5	111	1:1.59	Brazil
	♂	69	106.3	1:1.54	Key West
	♂	58	85	1:1.46	Egmont Key
	♀	34.3	46.5	1:1.35	Bermuda
	♂	22	27	1:1.23	Vineyard Sound
3166	♂	32	42	1:1.31	Bermuda
3165	♀	65	90	1:1.38	Bermuda

The first seven series of the above are by Prof. S. I. Smith.

Measurements.

No.	Sex	Carapace length	Carapace breadth total	Carapace breadth —spines	Chelæ length	Chelæ height	Locality
3165	♀	65	90	84	51	46.5	Bermuda
3166	♂	32	42	38	23	21.5	Bermuda
7567	♂	58	86	72.6	--	--	Sabanilla
7676	♀	60	85	73	--	--	Jamaica
	♀	34	46.5	40	--	--	Bermuda
	♀	54	78	70.5	--	--	Egmont Key

This species has large and curiously shaped larval stages (see S. I. Smith, these Trans., iv, p. 263). It evidently lives a long time in the free-swimming zoea and megalops forms. This, no doubt, accounts in part, at least, for its wide distribution. At Bermuda it is common in sheltered sandy bays and lagoons in shallow water, but is probably more abundant at greater depths. It was taken by us in Castle Harbor and Hungry Bay. It was in the early collections of J. M. Jones, Mr. Goode, C. Hartt Merriam, and others.

Its normal range extends from off Cape Hatteras to Brazil and S. Africa. Taken by the Albatross in 1884, off N. Carolina, in 13–27 fathoms (Smith). Beaufort, N. C. (Stimpson, Kingsley) ; Charleston, S. C. (Gibbes); Egmont Key, W. Fla. (Yale Mus.); Dominica I., taken in fish-pots in 5–10 fathoms (A. H. Verrill, 1906, Yale Mus.); Brazil (Smith); Simons Bay, Cape G. Hope (Miers).

The megalops stages are frequently carried northward by the Gulf Stream to southern New England at Woods Hole, Newport, etc., in large numbers. In mild winters a few survive. Specimens 1 to 2 inches across have been taken at Woods Hole by Mr. Vinal Edwards and others. (See S. I. Smith, these Trans., iv, p. 263.)

Calappa gallus (Herbst) Latr., var. **galloides** (Stimp.). *Yellow Box Crab.*

Cancer gallus (*pars*) Herbst, op. cit., iii, pt. 3, pp. 18, 46, pl. lviii, fig. 1, 1803.
Cancer (*Calappa*) *gallus* (*pars*) Latr., Règ. Anim., iii, p. 24, 1817.
Calappa gallus H. M.-Edw., Hist. nat. Crust., ii, p. 105, 1837. Dana, Crust. U. S. Expl. Exp., p. 393, 1852. Capello, Journ. Sci. Math., Phys. Nat. Lisboa, iii, p. 133, pl. ii, fig. 4, 1871 (W. Africa).
Miers, Voy. Challenger, xvii, p. 286, 1886 (Bermuda). Rankin, op. cit., p. 533. M. J. Rathbun, Decapod Crust. W. Africa, Proc. U. S. Nat. Mus., xxii, p. 297, 1900; Brach. and Macr. Porto Rico, p. 85, 1901.
Cancer galloides Stimpson, Ann. Lyc. Nat. Hist. N. York, vii, p. 71, 1859.

Figure 45. Plate XXVI, Figures 3.

Color of upper parts generally orange to orange-brown, becoming brighter on the front of the chelæ; under parts dull yellow. Carapace, above, and front of chelæ, covered with irreguiar spots of dark red or reddish brown, variable in size and form; many of the larger

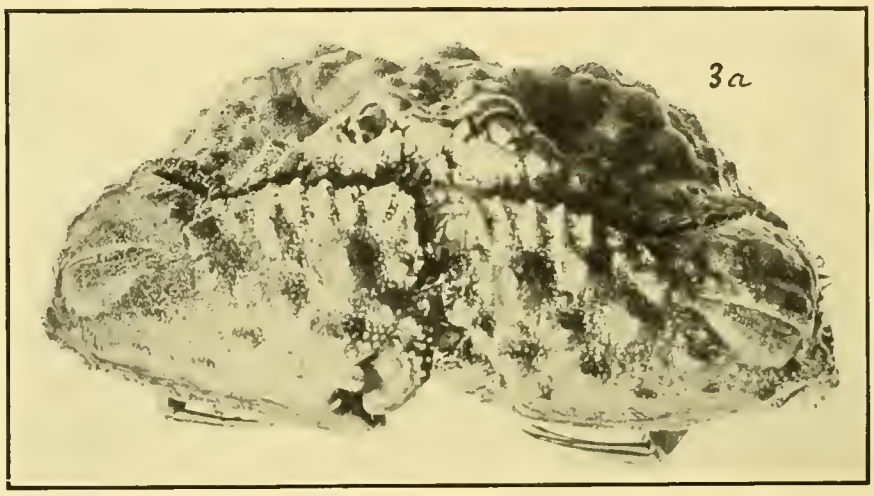

Figure 45.—*Calappa gallus, galloides*, front view, about nat. size. Phot. A. H. V.

granules and tubercles of the carapace are white, especially those that lie in rows on the posterior transverse ridges and those on the scattered elevations. This causes the elevations to appear higher than they really are. The digits of the chelæ are smoky horn-color, becoming blackish on the upper side of the dactyl. Ambulatory legs yellow, finely reticulated with red lines.

Measurements.

No.	Sex	Carapace length	Carapace breadth total	Front bet. orbits	Chelæ length	Chelæ height	Locality
1903*k*	♂	51	66	8	r. 39 / l. 38	32 / 32	Bermuda

This was first recorded from Bermuda by Miers. We took good specimens in March, 1901, in shallow sandy places in Castle Harbor. The Bermuda Biological Station had it from Hungry Bay. It was also in Prof. Kincaid's collection (1903*k*). It was not in the early collections of Jones, Goode, etc.

The Atlantic form (var. *galloides*) ranges from Florida to Bahia, Brazil, and West Africa. Cape Verde Islands and Fernando Noronha (Miers). Common in the West Indies; Dominica I., in fish-traps, 20–30 fathoms (A. H. Verrill, 1906, Yale Mus.). Bahia (Rathbun).

The typical Pacific form (var. *gallus*) has a wide range through the Indian and Pacific Oceans; Red Sea; Persian Gulf, etc. Philippines (Miers).

Cycloes Bairdii Stimp., var. **atlantica** nov.

Cyclois Bairdii Stimpson, Annals Lyc. Nat. Hist. N. York, vii, p. 237 [109] 1860 (Cape St. Lucas). Verrill, these Trans. xi, p. 18, pl. ii, figs. 1, 2, 1901 (Bermuda).

Cycloës Bairdii M. J. Rathbun, Proc. U. S. Nat. Mus., xxi, p. 610, 1898; Brach. and Macr. Porto Rico, p. 85, 1901.

Figures 46, 47. Plate XXVII, Figure 2.

The carapace is evenly rounded in front of the lateral teeth; surface strongly areolated and rough with unequal granules and low

Figure 46.—*Cycloes Bairdii*, var. *atlantica*, No. 4050, $\frac{9}{10}$ nat. size. Phot. A. H. V.

rounded tubercles; a median row and two or three irregular series on each side most prominent; antero-lateral margins with many small unequal denticles and granules; posterior lateral tooth larger, triangular, with the tip bent forward and acute. Front with two

subacute denticles. Chelipeds strongly granulated, and with a few irregularly arranged small tubercles on the outer surface of the manus; lower margin double, with two rows of large granules; crest high and convexly rounded, with seven acute angular teeth, of which the third is highest; dactylus of one chela (the right in our specimens) with a large, stout, downward bent tooth near the base, when closed fitting into a socket between a tooth on the thumb and a large obtuse tooth on the manus; a large, flat, rounded distal tooth near the lower edge.

Its colors are bright in life. The carapace is pale yellow or whitish with lemon-yellow spots in irregular rows, and many small bright red or crimson spots, especially laterally. Chelipeds and legs bright yellow, spotted and banded with bright scarlet red; chelæ with a crescent of red at the articulation of the dactylus on the inside; tips of digits and teeth of the dorsal crest of manus red; carpus with two red spots. Legs bright yellow, with bands of red and purple, and purplish red margins on the merus; eye stalks orange.

There is a close fringe of slender yellowish hairs on the dorsal crest of the carpus, manus, and dactylus of the chelipeds, and transverse fringes at the joints; the merus has two hairy lines forming a V-shaped figure on its upper surface; on the inner surface of the manus there is a Y-shaped arrangement of long hairs, and a dense distal tuft on the thumb; the ambulatory legs have a dorsal fringe of hairs and also transverse ones at the joints. The under side of the carapace and the outer maxillipeds are also covered with long yellow hairs.

Measurements.

No.	Sex	Carapace length	Carapace breadth	Ratio	Chelæ length	Chelæ height	Locality
4050	♀	32	33	1:1.03	16.5	12.5	Bermuda
1424*a*	♂	35	36.5	1:1.04	26	21	C. St. Lucas (typical)
1424*b*	♀	36	37.5	1:1.04	26.5	21.5	" " "

Our form is so very similar to *C. Bairdii* of the Pacific coast that it can hardly be separated as a species. I have been able to compare it carefully with specimens from Panama and with two specimens,* male and female, from Stimpson's type-locality (Cape St. Lucas, coll. Xantus, Yale Mus.). The latter are, however, larger than our best Bermuda specimen, which is an immature female. The Bermuda

* See plate xxvii, figure 2, photo. from one of these.

form has the carapace more strongly areolated and appears rougher, owing to the relatively larger granules and more elevated tubercles. The two frontal teeth are more acute and have a small lobe or shoulder on the outer edge, while those of *C. Bairdii* are obtuse at tips and have no lobe. The carapace has the posterior lateral spines sharper, longer, and farther back, in the Atlantic form, and the sides are more rapidly contracted behind the spines; the crests of the chelæ are higher and the edge more convex, the third tooth from the front being longest, while in typical *C. Bairdii* the second is longest. These teeth in the former are angular or carinate on the front side, while in the latter they are evenly convex; they are granulated in both. The outer surface of the chelæ has fewer but larger tubercules in the Atlantic form, and the lower edge is bevelled

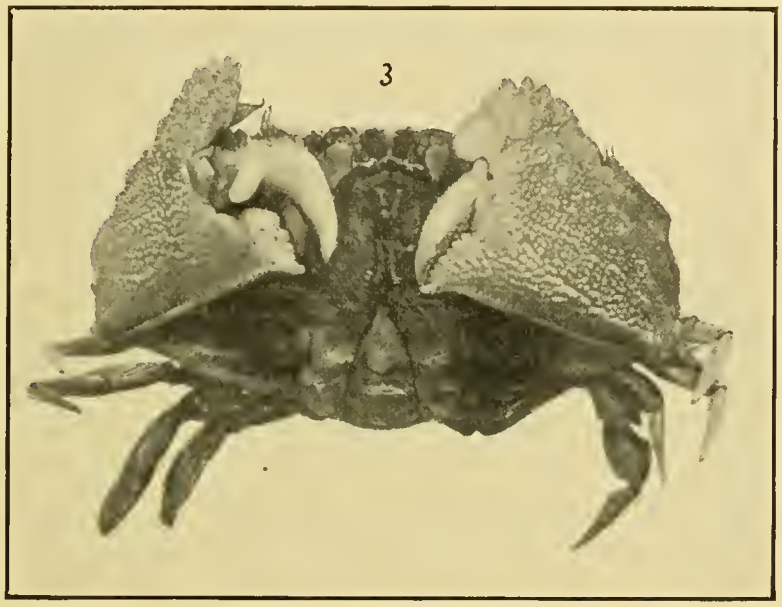

Figure 47.—*Cycloes Bairdii*, var. *atlantica*, from Bermuda, under side, × about 1¼. Phot. A. H. V.

and has two rows of small rounded granule-like denticles, while in *O. Bairdii* it is flatter, with two rows of larger obtuse denticles. The large tooth, near the lower proximal end, is acute-triangular in *O. Bairdii;* broadly rounded and obtuse in the Atlantic form.

There are various other minor differences, but whether they are constant or not is uncertain, on account of the small number of Atlantic specimens available for comparison. I have not been able to compare the male appendages.

There is much difference in the abdomen, but this is evidently largely due to the immaturity of the smaller specimen.

Two specimens of this species were taken in shallow water, in a sandy cove of Castle Harbor, near Walsingham Bay, in March, 1901 (coll. A. H. Verrill, Yale Mus.). Cast-off shells were found elsewhere, of larger size. Bahamas, six fathoms, and Porto Rico (Rathbun).

The Pacific form ranges from the Gulf of California to Panama. Cape St. Lucas (Stimpson, coll. Xantus, Yale Mus.). Panama (Capt. V. Dow, Yale Mus.).

HAPALOCARCINIDEA, nov.

The position of the family *Hapalocarcinidæ* in the system seems to be decidedly doubtful. Stimpson thought his genus was most nearly related to the Grapsoids.

Heller placed his genus, *Cryptochirus*, next to the *Pinnotheridæ*. Miss Rathbun (Crust. Haw. Is., 1906) placed the family at the end of the *Oxystomata*, in proximity to the *Dorippidæ* (*Ethusa*, etc.), to some of which there is considerable resemblance.

On the whole, it seems to me best to consider it as constituting a peculiar superfamily group, in which the genera are highly specialized, so as to adapt them to the peculiar habit of living in cavities, dens, or galls in the living parts of corals.

Each species hitherto discovered appears to represent a distinct genus, the genera differing among themselves widely in structure.

In general form and habits they superficially resemble some of the *Anomura*, especially the females, which have a large, elongated abdomen, in the form of a pouch, with all the sutures distinct, but not capable of curling up closely beneath the thorax, but there are no appendages on the sixth segment. The abdomen of the males is narrow and is applied closely to the sternum, as in ordinary Brachyura.

The epistome is feebly developed; the buccal area is large and arched anteriorly. The lower border of the orbit is little developed. The outer antennæ are small and extraorbital. The antennules have a large, prominent basal joint. The carapace is narrow and more or less oblong, or semicylindrical, not much narrowed anteriorly. The front is usually subtruncate or emarginate without a central tooth.

The outer maxillipeds are separated at base by a sternal lobe; they have the ischium broad, often with a convex inner lobe; the merus is small, seated well back, with the palpus articulated in a notch of the inner edge; the exognath is small.

The chelipeds are feeble, often little if any larger than the next legs; the chelæ are simple, with acute tips. The ambulatory legs

are all similar, short, with short, sharp, hooked claws, for strong adhesion. The posterior ones are not articulated much higher up than the others.

Family **HAPALOCARCINIDÆ.**

Troglocarcinus, gen. nov.

This generic name is proposed for a curious crustacean that inhabits holes and dens in the growing surface of living corals.

It is evidently closely related to the *Hapalocarcinus marsupialis* Stimpson of the Hawaiian Islands, which occupies gall-like nests between the living branches of *Pocillopora*. As in the latter, the abdomen of the female forms a capacious egg-pouch.

It differs in having the front of the carapace abruptly bent downward and operculum-like; in having the antero-lateral margin and front denticulate; in the form of the maxillipeds; and in several other characters. The eyes are not retractile; orbits feebly developed; a spine on the outer margin.

Troglocarcinus corallicola, sp. nov.

Figures 48, 49, *a*, *b*, *c*. Plate XXVIII, Figure 8.

Carapace oblong, transversely convex; the sides nearly parallel posteriorly; front abruptly bent downward and covered with small, unequal, sharp spinules and hairs to which dirt, etc., firmly adheres; front edge minutely notched in the middle and finely spinulated; antero-lateral margin with a row of fine sharp spinules; upper surface, back of the frontal bend, hairy and granulated, the granules larger anteriorly and toward the sides; minute posteriorly. The sloping anterior part of the carapace has a concave area, each side of the median line. The antero-marginal spines decrease in size backward; the one at the exterior edge of the orbit is largest. The carapace is much higher or thicker in front, especially at the bend, than posteriorly. Sternum smooth, concave in the middle; genital openings of ♀ lunate, near together on the sternum.

Chelipeds small, in the female smaller than the first ambulatory legs; in the male about as stout, but not longer, hairy; chelæ small, with simple, acute digits. Ambulatory legs hairy, short, incurved, with simple, sharp, incurved claws; posterior legs becoming shorter, but similar to the others, articulated slightly higher up.

Eyes small on thick, short stalks; orbits looking forward. Pedicels of antennulæ large, longer than the eye-stalks, rather stout, near together, spinulose distally, with about three longer terminal spinules.

The antennules are small, folding vertically, the tips reaching but little beyond the eyes. Antennæ small, about as long as the eye-stalks. Outer maxillipeds have the merus short and broad, with a decided notch on the inner distal edge, at the articulation of palpus. The ischium is broader than long, with a rounded or semicircular lobe on its inner margin; exognath is small and short. The large palpi occupy about all the space to the bases of the antennules. The anterior lobe of the sternum separates the bases of the maxillipeds. Legs and maxillipeds very hairy.

The abdomen is convex and has the rings thin, but somewhat indurated above. In the female the edges are expanded and form a well developed egg-pouch below, containing eggs in two specimens.

Figure 48.—*Troglocarcinus corallicola*, ♀, anterior parts, from below; diagrammatic sketch, much enlarged, from a Dominica specimen.

This curious species lives in oven-shaped cavities or dens formed in the upper surface of living corals, especially of *Mussa*, *Mæandra*, *Dichocœnia*, etc.; as many as 8–12 such cavities are sometimes found in a coral six inches in diameter. The opening of the den is usually semicircular or lunate, commonly oblique to the surface of the coral; the opening being preserved, no doubt, by the friction due to the constant motions of the crab. The downturned, rough, and dirt-covered front of the crab serves as a lid or operculum, closing the aperture very nicely. The crabs can leave their dens, at least when young, as they often do so when the fresh corals are put aside to dry. The full grown crabs are probably unable to leave their dens.*

Length of carapace in one of the larger females, 7^{mm}; breadth, 4^{mm}. This one carries eggs.

It does not appear to be common at Bermuda. Abundant at Dominica I., in *Mussa* and *Mæandra clivosa*, from 3–5 fathoms (A. H. V., 1906, Yale Mus.).

* In the figure pl. xxviii, fig. 8, the crab was intentionally placed in a den too large for it, in order to show its form.

It appears to be nearly allied to *Hapaloearcinus marsupialis* Stimpson,* which forms curious "houses" among the branches of *Pocillopora cæspitosa.* The branches of the coral, in the latter case, grow up around the crab and enclose it, leaving several small apertures for the entrance of water and food, but from which the crab cannot emerge.

In the latter, however, the front of the carapace is flat, not bent downward, and it does not serve for an operculum, which is not needed in its case.

49

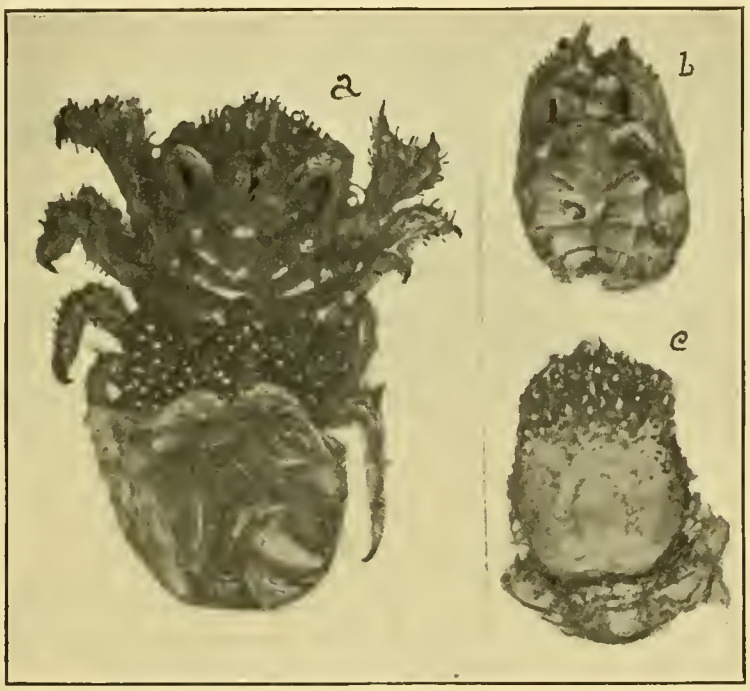

Figure 49.—*Troglocarcinus corallicola ; a*, dorsal view, × about 4 times, of a ♀ removed from its den in a coral (*Mussa*), from Dominica I.; *b*, a smaller ♀ specimen, × about 4 times, ventral view ; the abdomen, legs, outer maxillipeds, and antennules are removed, except one basal antennular segment ; *c*, the same, another ♀ example ; dorsal view, ×4. Phot. A. H. V.

It is, perhaps, more closely allied to *Cryptochirus coralliodytes* Heller,† from the Red Sea and Maldives, which lives in the same manner, in dens in *Leptoria* (=*Mæandra*).

The latter, however, has a differently formed carapace, smooth, convex in front, without marginal spines ; orbits simple, without spines ; and very different maxillipeds.

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* Proc. Boston Soc. Nat. Hist., vol. vi, p. 412, 1859. Calman, Trans. Linn. Soc. London, ser. 2, vol. viii, p. 43, pl. iii, figs. 29–40, 1900. M. J. Rathbun, Crust. Hawaiian Is., U. S. Fish Com. Bulletin, for 1903, part iii, p. 892, 1906.

† Heller, Cam., Sitzungsb. Math.-Naturwiss. Classe. Akad. Wissenschaften, Wien, xliii, i, 1861, p. 366, pl. iv, figs. 33–39.

DROMIACEA de Haan, 1839, *Dromides.*

Dromiaceæ Boas, 1880. A. M.-Edw. and Bouvier, 1899 and 1900.
Dromiacea or Dromides Alcock, 1901.
Brachyura anomala Stebbing, 1900, 1903.
Anomura (*pars*) Dana and many other authors.
Dromidea Ortmann, 1896.

The relations of this rather anomalous group are recognized by nearly all modern writers to be rather with the Brachyura than with the remainder of the old group *Anomura*. It includes, according to Alcock and Stebbing, two superfamily groups: *Dromiidea* (restricted) and *Homolidea*.

Family **DROMIDÆ**. *Sponge-carrying Crabs.*

This small and curious family is represented in the Bermudas by the two more common West Indian species, but both have been discovered only recently, in rather deep water. Both were dredged on the "Challenger" and "Argus" Banks. Both species carry a living sponge over the back, for concealment and protection. They use various species of sponges for this purpose, holding the sponge in position by means of the two posterior pairs of legs, which bend upward for this purpose.

Dromia erythropus (Geo. Edw.) Rathbun.

Cancer erythropus Geo. Edwards, in Catesby, Nat. Hist. Carolina, etc., ed. of 1771, ii, p. 37, pl. xxxvii.
Dromia lator H. M.-Edw., Hist. nat. Crust., ii, p. 174, 1837.
Dromia erythropus M. J. Rathbun, Annals Inst. Jamaica, i, p. 39, 1897; Results of Branner-Agassiz Exped. to Brazil, Proc. Wash. Acad. Science, ii, p. 143, 1900. Benedict, Anomura Porto Rico, p. 172, 1901 (descr.).

Figure 50.

In life this species is densely covered with dark brown or blackish stiff hairs, only the tips of the dactylus being naked; these are light red. Beneath the hairs the surface is whitish. It grows to considerable size; the carapace is often 70 to 75^{mm} broad. It always covers its back with a concave fragment of some living sponge, but numerous species of sponges are used for this purpose. Very often it is some light silicious sponge of the family *Chalinidæ*, as *Spinosella sororia;* in other cases it is a tough compact species belonging to the *Suberitidæ;* in several cases it was a keratose sponge of the genus *Hircina;* one from Dominica carried a large concave mass of a silicious sponge of the genus *Agelas*, several times its own bulk.

The only Bermuda specimen known to me was obtained by the party from the Field Mus. Nat. Hist. on the Argus Bank, 30–40 fathoms, Oct. 13, 1905. It was taken from the stomach of a Hamlet Grouper, and was, consequently, badly damaged. It was a large specimen.

Its range is from Florida to Pernambuco, Brazil (Rathbun).

A number of large specimens, in the Yale Mus., were collected at Dominica, 1906, by A. H. Verrill. They were caught in fish-traps set in 50–150 fathoms.

Figure 50.—*Dromia erythropus* from Dominica, with a flat Chalinid sponge held over its back, about ½ nat. size. Phot. A. H. V.

Dromidia antillensis Stimpson.

Dromidia antillensis Stimpson, Proc. Acad. Nat. Sci., Philad., for 1858, p. 225; Annals Lyc. Nat. Hist. N. York, vii, p. 71, 1859. Smith, these Trans., ii, p. 17, 1869 (meas.). Benedict, Anom. Coll. Porto Rico, p. 132, 1901.

Figure 51. Plate XXVIII, Figures 2, 3.

The carapace, which is about as long as broad, is convex in both directions, high in the middle, and pretty evenly rounded, covered with fine, close, yellowish hairs, beneath which it is white, nearly smooth, minutely punctate. Similar hairs cover the chelipeds; those of the other legs are longer. The narrow front is abruptly bent downward at tip; it bears three small obtuse teeth standing equally spaced, forming a triangle, in a front view; the inner orbital tooth is small and acute; the superior orbital is nearly as large and acute; the inferior orbital is similar to the frontal spines in size and form. There are four small, acute lateral spines, of which the first two are stouter, and divergent, the first a little larger; the 3d and 4th are strongly hooked forward at the tip and very acute. The carpus of the chelipeds has three distal, subspiniform angles, the

upper one smaller, obtuse; the two outer ones prominent, subacute. The manus is carinate above, with 4 or 5 small granule-like denticles on the edge; the thumb and dactylus are strongly excavated at tip and bear 5 or 6 serrate teeth, on the outer edge, the distal ones largest. The last two legs are sharply subchelate at tips, the last most perfectly so.

Figure 51.—*Dromidia antillensis*, under side, × about 1½. Phot. A. H. V.

Color, in alcohol, white under the yellowish pubescence; chelæ with light red or flesh-colored, partly naked fingers, white at the tips.

It always protects itself by means of a living sponge (sometimes a compound ascidian) held over its back by the posterior two pairs of legs. The carapace is about as long as broad.

Measurements of Carapace for variations of Ratios.

No.	Sex	Carapace length	Carapace breadth	Ratios	Locality
831*a*	♂	15.5	15.6	1:1.01	Brazil
831*b*, fig.	♂	18.2	18.5	1:1.02	"
831*c*	♀	16.0	16.0	1:1.00	"
831*d*	♀	18.0	18.2	1:1.01	"
703, fig.	♂	12.5	13.5	1:1.08	Bermuda

The first four series of measurements are by Prof. S. I. Smith.

In No. 831*b*, the chelæ are relatively much larger than in the Bermuda example, probably owing to its maturity; length of chela, 12.5^{mm}; height, 6.5^{mm}; the manus has a row of four conspicuous denticles on upper edge, proximally; the edges of the digits are strongly and coarsely toothed. The carpus has three conspicuous distal tuberculiform teeth. The lateral teeth of the carapace are conspicuous, the two anterior ones the larger and less acute; on the left side the 2d tooth is double. The preorbital and suborbital teeth are about as large as the lateral.

A single specimen was dredged by the party from the Bermuda Biological Station on the Challenger Bank in 1903.

It agrees pretty closely with Stimpson's original description, except as to the form and relative size of the lateral spines. But it does not agree so well with Mr. Benedict's later description, in several characters. The differences may be due to age, or there may be distinct local races or varieties. More specimens are needed to determine this.

The range of the species is from Mexico and west coast of Florida to the Abrolhos, Brazil. Florida and St. Thomas (Stimpson). Santa Cruz (Yale Mus., 1018, coll. Dr. Bishop); Abrolhos Is., Brazil, No. 831 (Smith); Porto Rico (Rathbun); Bahamas (Rankin); east coast of Mexico (Yale Mus.).

HETEROMACRURA, nom. nov.=**ANOMURA** (in part).

Anomura or *Anomoura* M.-Edw. (*pars*); Dana (*pars*); Henderson (*pars*); and many other authors.

Macrura anomala Alcock, 1901; Stebbing, 1903.

This group seems to lack a suitable name. At least there is great diversity in the use of former names.

Anomura is still used, as it has been for the past fifty years or more, in very diverse senses. Therefore it will save confusion to abandon it, unless as a loosely applied general term.

"Anomala" (de Haan), being an adjective term, has been used in many diverse senses, not only in Crustacea, but in other groups also. Hence I now propose to give this group the above name.

It includes the superfamily groups: *Galatheidea*, *Hippidea*, *Paguridea*.

GALATHEIDEA *Henderson.*

Porcellanoidea + *Galatheoidea* Stimpson, 1860.

This group as defined by Henderson, Ortmann, Alcock, and other recent writers, includes the families *Porcellanidæ*, *Galatheidæ*, and some others.

Family **PORCELLANIDÆ.**

It is remarkable that only one species of this large family has hitherto been found at the Bermudas, for numerous other species occur on the reefs of the West Indies and Florida.

Petrolisthes armatus (Gibbes) Stimp.

Porcellana armata Gibbes, op. cit., p. 190, 1850.

Petrolisthes armatus Stimpson, Proc. Acad. Nat. Sci., Philad., 1858, p. 227; Ann. Lyc. Nat. Hist. N. York, vii, p. 73, 1860. Kingsley, Proc. Acad. Nat. Sci., Philad., 1879, p. 406. Ortmann, Zoöl. Jahr., x, p. 280, 1897. Benedict, Anomura Porto Rico, p. 133, 1901.

Plate XXVII, Figure 3. Plate XXVIII, Figure 4.

Color variable; carapace, in life, often yellowish green, with minute white spots, legs similar, except on the last two joints, which have white transverse bands; under surfaces pale yellow or white, except the large chelæ, which are pale blue (C. S. V.).

Some specimens are dark gray above, finely spotted with white and light gray. Others are red or reddish brown, thickly specked and spotted with white or yellowish white.

The colors are imitative of the sand, gravel, stones, algæ, etc.

The median tooth of the front is obtuse. There is a very distinct, transverse, granulated ridge across the front. The merus of the chelipeds usually has three (rarely 4) sharp teeth on the inner margin; the outer margin is finely serrulate.

The chelæ are large, flat, angular; the manus has a distinct, granulated, raised line on the outside.

One of our larger male specimens has the carapace 11.5^{mm} long; 9.5^{mm} broad; between orbits, 5^{mm}; merus of chelipeds, 10^{mm} long; larger chela, 18^{mm} long; 7.3^{mm} high. The larger chela is stouter than the other, with shorter and stouter digits, which are laterally incurved and slightly crossed at the tips.

Variety **pallidus**, nov.

Many Bermuda specimens differ from the ordinary form in having the carapace nearly smooth, with scarcely any traces of the transverse rugæ and granules, so conspicuous in the typical form, and in lacking the coarse granules on the outer surface of the chelæ. The color is usually white or pale yellow. The chelæ are the same in form and carinæ, and the merus of the chelipeds has three sharp, spaced teeth on the front edge, as in *armatus*. In most other respects there are no differences between them. Whether it has the same habits was not noted. Length of carapace, 8–10^{mm}.

This species is very common at Bermuda. It lives under stones and in the interstices and crevices of dead corals, etc. It was in the early collections of J. M. Jones, and has been taken by nearly all

later collectors. Its range is very extensive; from off Cape Hatteras to Maceio, Brazil; from Panama to southern California; Pacific Islands; Indian Ocean, etc. Common on the Florida reefs and Keys, and in the West Indies. Colon, Key West, and Egmont Key, W. Florida (Yale Mus.). Gulf of Calif. (Lockington).

Family **GALATHEIDÆ** Dana.

Munida Beanii, sp. nov.

FIGURE 52. PLATE XXVII, FIGURES 8, 9.

A small species, with an ovate carapace, widest opposite the third pair of legs. Transverse, elevated, ciliated ridges are well separated; about sixteen on the carapace, of which four or five are incomplete. Marginal spines about eight, small, acute, the most anterior largest;

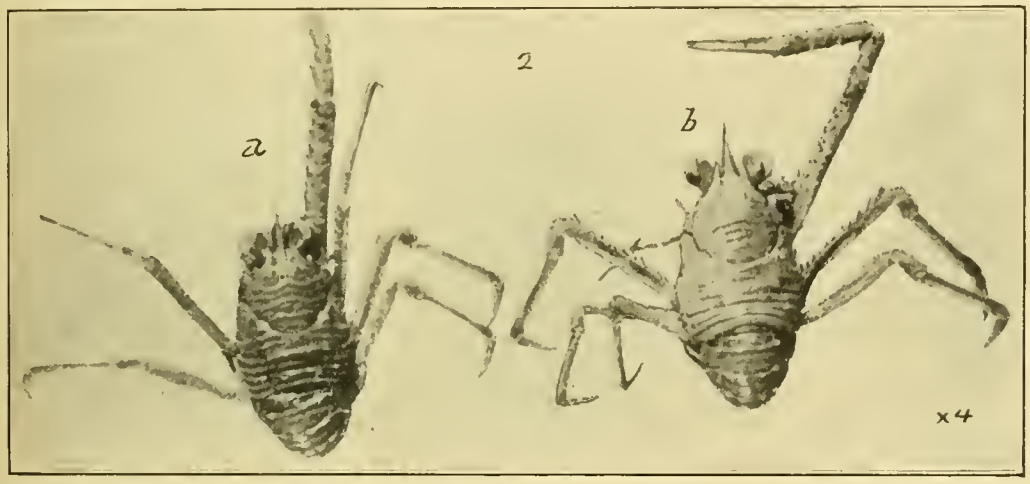

Figure 52—*Munida Beanii; a*, dorsal view of specimen with shorter ocular spines; *b*, specimen with longer ocular spines, × about 3 times. Phot. A. H. V.

dorsal spines ten, very small; of these there are three on each side, anteriorly, in an obliquely transverse line, nearly parallel with the post-orbital border; the inner one is largest; a single spine on each side, behind the second ciliated ridge; a single one, on each side, behind the cervical groove.

Rostrum moderately long, tapered, nearly smooth, acute, triquetral, or with a slight dorsal carina. Orbital spines lanceolate, with sharply acuminate tips, in some cases nearly half as long as the rostrum and reaching the cornea of the eyes; in others not over one-third as long as the rostrum and shorter than the eye-stalk.

Eyes large on rather long, stout stalks; in several specimens the right eye is distinctly larger than the left (see figures). Chelipeds slender; the merus is nearly as long as the chela; the fingers gape at base, at least in the male, the thumb being curved downward at base rather abruptly; outer edge of thumb finely denticulate beyond the curve, edge and tips of finger fringed with short hairs. Entire surface of chelipeds finely spinulose, with minute flat transverse rugæ between the spinules, having ciliated edges. Ambulatory legs also spinulose. The largest specimen has the carapace 7.5^{mm} long; 4.5 wide; length of merus of cheliped, 8^{mm}; of chela, 9; of dactylus, 4^{mm}. Another specimen had the carapace 7^{mm} long, 4^{mm} wide. This species is closely allied to *M. simplex* Benedict, but Mr. Benedict, who has examined the specimens, considers them distinct. In the latter there are two pairs of spines behind the cervical suture; the rostrum is longer and more slender; the chelipeds are longer, and the chelæ longer in proportion to merus. Possibly these differences may be due in part or wholly to immaturity.

Seven specimens, No. 893, were dredged in 50 fathoms, on the Argus Bank, Oct. 13, 1905, by the expedition from the Field Museum of Natural History, under Dr. T. H. Bean, to whom it is dedicated.

HIPPIDEA, de Haan.

Hippidea Stimpson, 1859. *Hippoidea* Stimpson, 1860. *Hippidea* Ortmann, 1896.

Family **HIPPIDÆ** Stimpson.

Hippa Fabricius (restr.).

Hippa (*pars*) Fabr., Mant. Insect., pp. 329, 330, 1787; (restr.) 1798, type *H. adactyla*.

Remipes Latreille, 1806, and most later authors.

Hippa M. J. Rathbun, Proc. U. S. Nat. Mus., xxii, p. 301, 1900 (*non* M.-Edw.).

Miss Rathbun has restricted this generic name to the group typified by *adactyla*, the only species left in the genus by its author, in 1798.

Hippa cubensis (Saussure) Rathbun. *Sand-bug.*

Remipes cubensis Saussure, Rev. Mag. Zool., (2), ix, p. 503, 1857; Crust. Antilles and Mex., Mem. Soc. Phys. Nat. Hist. Genève, xiv, p. 452, pl. ii, figs. 19, 20, 1858. Rankin, Ann. N. Y. Acad., xi, p. 237; op. cit., xii, p. 533 (Bermuda).

Remipes scutellatus Miers, Jour. Linn. Soc. London, xiv, 1879, p. 319. Henderson, Voy. Challenger, Zoöl., xxvii, p. 138, 1888. (? Not *Hippa scutellata* Fabricius, Ent. Syst., ii, p. 474, 1793.)

Remipes Barbadensis Stimpson, Proc. Philad. Acad., 1858, p. 229 [67]; Ann. Lyc. Nat. Hist. N. York, x, p. 120, 1871.

Hippa cubensis Rathbun, Proc. U. S. Nat. Mus., xxii, p. 300, 1900 (W. Africa).

FIGURES 53, 54.

The carapace is somewhat depressed. The antennæ are much smaller than in the related species of the eastern U. S. coast. (*Emerita talpoidea.*)

The females are much larger than the males and usually more numerous in collections.

Our specimens, taken in spring and October, are without eggs. Henderson records a number of specimens taken at Bermuda by the Challenger, in May, several of which carried eggs.

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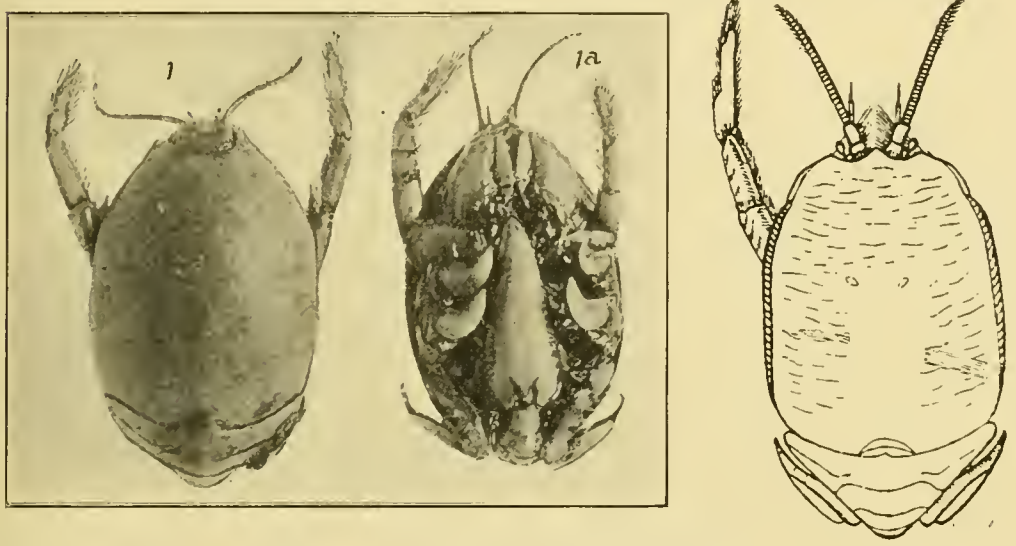

Figure 53.—*Hippa cubensis;* 1, dorsal; 1*a*, ventral view; × about 1¼. Phot. A. H. V.

Figure 54.—The same; carapace, enlarged, after Saussure.

Adult female specimens are about 20 to 23^{mm} long, by 17 to 19^{mm} wide; the males are about 12^{mm} long. One of the largest females is 22^{mm} long; 18.5 wide.

It lives in the shifting sands at and below low-tide level. When laid bare by the waves it can quickly retreat backward into the sand for some depth.

It is not uncommon at Bermuda, on sandy shores, but requires special search. It was in the early collections of Jones, Goode, and Merriam. Also obtained by the Challenger Expedition. Rankin records it from Cooper's Island.

Its range is from the Florida Keys to Brazil and to West Africa and the adjacent islands. Common in most of the West Indies. Abundant on the shores of Cuba (Saussure); Old Providence, April, 9, 1884, with eggs (Str. Albatross, Smith).

Cape Verde Islands (Studer, Miers, etc.); Dahomey (Osorio); Quinchoxo (Studer); Ascension Island (Miers, Benedict); Bahamas (Rankin); Dominica I. (A. H. Verrill, 1906). Brazil (coll. Hartt, Yale Mus.).

Family **ALBUNEIDÆ** Stimpson.

Albunea oxyophthalma Miers.

Miers, Jour. Linn. Soc. London, xiv, p. 329, pl. v, figs. 14, 15, 1879. Benedict, Anom. Crust. Porto Rico, p. 139, 1901. Verrill, these Trans., xi, pp. 18, 62, pl. viii, fig. 1, 1901 (Bermuda, *oxycephala* on p. 18 by error).

? *Albunea Parelii* Guerin, Rev. et Mag. de Zoöl., ser. ii, vol. v, p. 48, pl. i, fig. 10. Kingsley, Proc. Philad. Acad. Sci. for 1879, p. 409 (W. Florida).

Plate XXVIII, Figure 1.

This species is peculiar in having eleven or twelve spines each side of the central rostral tooth, and unusually long eye-stalks. In the closely related species (*A. Gibbesii*) of the U. S. coast, there are only nine or ten teeth on each side.

The only Bermuda specimen known to me is the one recorded in 1901. It was found buried in the beach sand by Mr. T. G. Gosling. It is, no doubt, nocturnal in its habits.

Its range is from West Florida to Brazil. St. Christophers, Cayenne, and Brazil (Miers). Sarasota Bay, W. Florida (Kingsley).

PAGURIDEA, Stimpson, 1859.

Family **CENOBITIDÆ.** *Land Hermit Crabs.*

Cenobita Diogenes (Latr.) Edw. *Land Hermit Crab.*

Pagurus Diogenes Latr., Encyc., pl. 284, figs. 2, 3 (after Catesby).

Cenobita Diogenes H. M.-Edw., Hist. nat. Crust., ii, p. 240, pl. ii, figs. 11–14, 1837. Smith, these Trans., ii, p. 38 (Brazil). Rankin, op. cit., p. 533, 1900 (Bermuda). Benedict, Anomura Porto Rico, p. 139, 1901 (descr.). Verrill, Geology of Bermuda, Amer. Journ. Science, ix, p. 338, 1899, fig. 12; these Trans., vol. xi, pp. 464, 708, fig. 22*a*; The Bermuda Islands, pp. 52, 296, fig. 22*a* (habits); these Trans., vol. xii, pp. 158, 179, 196, 197, fig. 60, 1906 (fossil).

Figure 55.

This is the only land hermit crab of this faunal region. Easily recognized by the large, massive, purplish left chela; stout ambulatory legs; the wide compressed propodus of the left leg of the second pair; and the compressed eye-stalks.

Not uncommon at Bermuda and often found on the high sand hills, far away from the shore, and in gardens. Large specimens usually occupy fossil shells of *Livona pica*, which have weathered out from the soft æolian limestones. These fossil shells were doubtless carried from the shore to the ancient sand dunes by the remote ancestors of these same crabs.

Figure 55.—Land Hermit Crab in shell of *Livona pica*, about ⅔ nat. size. From living specimen by A. H. V.

Its range is from Florida Keys to Brazil. Key West, Santa Cruz, Dominica I. (Yale Mus.). Andros I. and Nassau (Rankin). Found on nearly all West India Islands.

A fossil Bermuda specimen, in a shell of *Livona pica*, is in the Yale Mus. (coll. Jones).

Family **PAGURIDÆ.** *Hermit Crabs.*

Calcinus sulcatus (M.-Edw.). Stimp. *Red Hermit Crab.*

Pagurus sulcatus M.-Edw., Ann. Sci. Nat., ser. 2, vi, p. 279, 1836 ; Hist. nat. Crust., ii, p. 230, 1837.

Calcinus sulcatus Stimpson, Proc. Acad. Nat. Sci., Philad., 1858, p. 234. S. I. Smith, these Trans., ii, p. 17, 1869 (Brazil). Hilgendorf, Monats. Preuss. Akad. Wiss., Berlin, 1878, p. 823. Henderson, Rep. Challenger, Zoöl., vol. xxvii, Anomura, p. 61. Verrill, these Trans., x, p. 578, 1900. Benedict, Proc. U. S. Nat. Mus., xvi, p. 939, 1893 ; Anom. Porto Rico, p. 141, pl. v, figs. 3, 3*a*, 1901 (descr.).

Pagurus tibicen White (*variety*), List of Crust. in the British Museum, p. 61.

Calcinus tibicen Rankin, Ann. N. York Acad., xii, p. 533, pl. xvii, fig. 1, 1900 (descr. colors, etc.).

Calcinus obscurus Stone, in Heilprin, op. cit., p. 149 (*non* Stimpson).

Figures 56, 57. Plate XXVIII, Figure 7.

The colors appear to be pretty constant, in the Bermuda examples, and last very well in formalin or alcohol. The legs and chelæ in

one of the fresher specimens are mostly dark red, becoming brighter red on the margins and at the joints ; the chelæ have a patch of dark olive brown on the middle of both sides of the palm ; the tips of the dactylus and thumb are white or pale yellow; the whole surface of the chelipeds and ambulatory legs, except on the white

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Figure 56.—*Calcinus sulcatus,* about natural size. Phot. A. H. V.

tips, is covered with very small round spots of blue ; these are also present on the carapace anteriorly. The ambulatory legs are brownish red or bright red, with a band of white or pale yellow on the distal end of the carpus and proximal end of the dactylus, and a narrower one at the base of the nail, which is black. The basal joints of the ambulatory legs are white and pale reddish underneath.

57

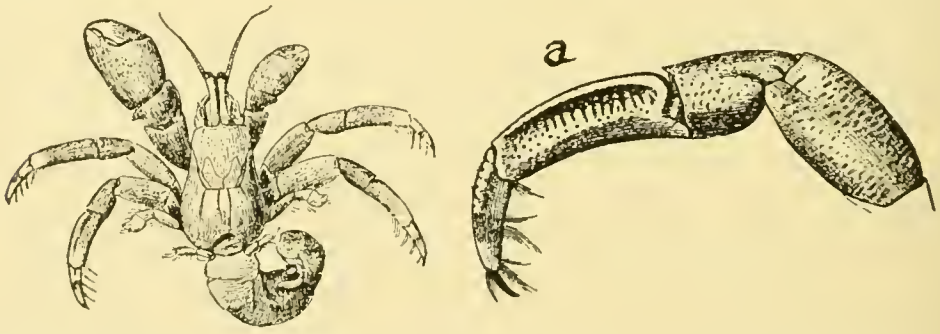


Figure 57.—*Calcinus sulcatus* removed from shell ; *a*, second left leg of same, more enlarged to show sulcus ; after Benedict.

The outer maxillipeds and the basal joints of the antennæ beneath are dark olive green or yellowish green ; flagellum of antennæ orange-yellow. The eye-stalks are light orange-red, with a pale yellow or white band close to the eye. The anterior part of the carapace is red or brown, like the chelæ, and has a median patch of dark olive-green; posterior part bluish white or purplish white, irregularly spotted with red or brown ; in some there is a large ill-defined patch of white about the suture or on the sides. The variations are mainly in the darker or lighter shades of color. The young

and some adults are pale red, instead of brownish red. In some there is but little white on the tips of the chelæ; this is often preceded by an orange tint; in some the white bands of the legs are bordered by pale purple.

Some of the females taken by the members of the Biological Station, in June and July, 1903, carried eggs.

"It is closely allied to *C. tibicen* Dana and *C. obscurus* Stimpson, but differs remarkably from both of them in the deep and rugose sulcus on the outer side of the propodus of the left leg of the second ambulatory pair. This sulcus is very marked, extends the whole length of the segment, and is limited on the upper side by a sharp carina. From the *obscurus* it differs moreover in having the carapax broader in front, and the antero-lateral angle more prominent, and not rounded as it is in that species."

"Length of body from front of carapax to tip of abdomen, 23.5^{mm}; length of left hand, 7.6; breadth of left hand 4.5." (S. I. Smith.)

This is a common species in shallow water at the Bermudas. We obtained numerous specimens in 1898 and 1901. It is in the early collections made by Jones, Goode, and Merriam. Dr. Rankin records females carrying eggs, taken in midsummer. It was also obtained by the Bermuda Biological Station, 1903, and the Field Nat. Hist. Museum, October, 1905.

Its range is from Florida to the Abrolhos Islands, Brazil (Smith). Pernambuco and Maceio, Brazil, on reefs (Rathbun).

Dardanus venosus (Edw.) *Red-veined Hermit Crab.*

Pagurus venosus H. M.-Edw., Ann. des. Sci. Nat., ser. 3, vol. x, p. 61, 1848. Stimpson, Notes, No. i, Ann. Lyc. Nat. Hist. N. York, vii, p. 82 [36], 1859.

Petrocheirus insignis M. J. Rathbun, Branner-Agassiz Exp. to Brazil, p. 144, 1900 (*non* Saus. sp.*). Verrill, these Trans., x, p. 578, 1900 (*non* Saus.).

Pagurias insignis Benedict, Anomura Porto Rico, p. 141, 1901 (descr., *non* Saus. sp.).

Figures 58, 59.

This species sometimes grows to large size. It is handsomely colored in life.

It has been repeatedly confused with *D. insignis*, as indicated in the synonymy,† but is very distinct from that species, as the accompanying figures show.

* *Pagurus insignis* Saussure, Crust. Antilles, Mex., Mem. Soc. Phys. Hist. Nat. Genève, xiv, p. 453, pl. iii, figs. 20, 20*a*, 1858.

† Stimpson's description was very brief, but characteristic. Mr. Benedict, op. cit., 1901, has given a much better description of it, under the name of *insignis*.

The following description is from large Dominica specimens. The carapace is broad posteriorly, and much narrower in front of the deep transverse groove; the harder anterior portion is longer than broad, with the posterior margin truncate medially, in front of which there is an incised V-shaped groove, and some lateral oblique ones; front edge with three rounded lobes, the middle one more obtuse and less prominent than the others and obscured by hairs; a strong submarginal bent-bow-shaped groove; sides of carapace hairy; middle part nearly smooth. Posterior part of carapace with swollen, broadly expanded flanks, covered with oblique and divergent grooves; posterior margin deeply emarginate.

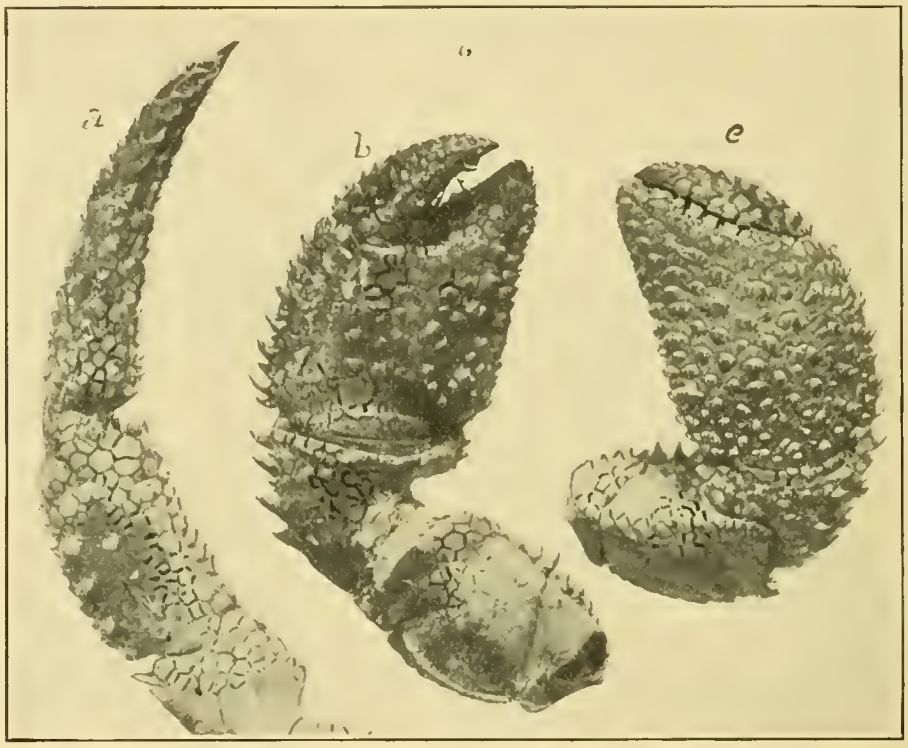


Figure 58.—*Dardanus venosus; a*, 2d ambulatory leg of left side, inner surface; *b*, the same, inner surface; *c*, left cheliped, outer surface; × about 1½. Phot. A. H. V.

The chelipeds are unequal, the left being decidedly larger, with the chela shorter, much more robust, and differently ornamented. The left cheliped has the merus triquetral, the two lower angles spinulose; the upper one serrate with flat teeth; the outer surface has slight rugæ and small tufts of hairs, otherwise the surface is smooth and glossy. The carpus is sharply spinulose above, five large acute spines stand on the upper edge; near the distal outer margin

the spinules are crowded in transverse rows, with close fan-shaped groups of yellowish plumose hairs arising from their outer bases. The manus is elegantly ornamented on the outer side with small, rounded, single and clustered tubercles, surrounded by regular stellate and fan-shaped groups of even plumose hairs that radiate horizontally from their bases, except on the proximal side, the tips of the adjacent groups of hairs mostly overlapping, so as to nearly cover the whole surface between the tubercles; toward the upper margin the tubercles become higher and more pointed or spiniform; those along the margin are acute spines, bent forward; on the thumb and dactyl the tubercles of each cluster blend together and form larger rounded tubercles, usually paler in color, but carrying plumose basal hairs; the thumb and dactyl each have, along the cutting edge, a row of five or six strong, rounded, paler teeth and are tipped with a narrow, subacute, but strong black nail or claw, excavate within.

The inner surface of the manus is rather smooth, with some scattered, unequal, rounded tubercles, especially on the lower half, and a regular row of larger ones along the lower margin. Many of these tubercles bear terminal clusters or pencils of slender hairs, especially those along the inner edges of the digits, where the pencils of hairs are larger and arise from pits. The dactyl is so articulated that it moves up and down in a nearly vertical plane.

The right chela is scarcely half as thick and more tapered. The tubercles of the outer surface are low or flattened, and bear comparatively few longer slender hairs, but those along the upper margin become acute spinules; on the inner surface the tubercles are flat or scarcely raised above the smooth surface, but have a central hair-bearing pit, and are marked out by the narrow red lines that surround most of the tubercles.

The left leg of the second ambulatory pair is very characteristic in its armature and ornamentation. The two distal segments are triquetral, owing to a strong carina that runs along the middle of the outer side, above which there is a wide and deep sulcus. This carina, on the propodus, carries, on its upper and outer surfaces, about ten or eleven oblique transverse rows of small appressed tubercles, arising from ridges, and decreasing in size downward; the proximal rows have six to eight, but the distal ones have only one or two tubercles; from the basal ridges arise crowded rows of short, appressed, plumose hairs, which cover the intervening spaces. On the dactylus the transverse ridges are shorter but more prominent

and the rows of tubercles decrease from about three, proximally, to one or two distally ; the ridges bear on the distal side plumose hairs, as on the propodus. The lower marginal carina bears one or two upper rows of subacute or conical tubercles, and an under row of larger, white, obtuse tubercles, with a pit bearing a pencil of long hairs, while the upper ones bear basal, plumose, appressed hairs. The distal articular margin is also fringed with long hairs. The upper outer surface also bears transverse rows of conical tubercles on raised ridges, carrying short plumose hairs on the distal side, as below ; on the propodus there may be three or four tubercles in a row, but on the dactyl there are but two or three, or only one distally, and the hairs are longer.

On the upper surface of the propodus there are two or three rows of large, mostly acute, often double, hair-bearing tubercles, with pencils of hairs arising from pits ; on the dactyl these tubercles become broader, truncate, or even concave, with clusters of numerous pits from which pencils of longer and stouter hairs arise. The terminal claw is short and black.

The second ambulatory leg of the right side, as mentioned by Stimpson, is also flattened, though less so than the left, and has near the margins of the propodus, above and below, flattened, transverse tubercles, which bear rows of small appressed hairs on the distal edge, becoming longer at the margins ; similar, but smaller flat tubercles are scattered on the middle portion, but there is no median carina.

The other ambulatory legs are more slender, and covered with appressed tubercles, bearing pencils of long hairs. The legs of the third pair have rather stout chelæ, and are very hairy.

The eye-stalks are stout, somewhat enlarged distally, with large black eyes ; they are shorter than the width of the anterior part of the carapace ; they bear scattered pencils of slender hairs.

The ocular scales are about as broad as long, well separated, with the outer end three-toothed, the inner tooth longest, minutely denticulate and fringed with hairs.

The aciculum of the antennæ is long, slender, acute, and very hairy. The antennulæ are much longer than the eye-stalks, which reach to about the middle of the last joint of the peduncle.

Specimens of large size, when recently dried, have the legs and chelipeds light orange, varying to red on the exposed surfaces, with the tubercles of the chelæ crimson or purple; those surfaces less exposed in life are paler orange or yellowish; under a lens the surfaces

of the chelipeds and legs are seen to be covered with a reticulation of narrow, bright red lines, which generally, also, surround and mark out the paler colored tubercles and spinules, but they may also form a network of small polygons on the smooth surfaces. When the chelæ and tubercles are red, as in some of the larger specimens, these lines become dark red, but are less conspicuous, especially on the outer surface, where the appressed hairs between the tubercles conceal them.

The ambulatory legs are usually crossed by three or four wide, rather conspicuous bands of red, one on each segment, or the red color may sometimes predominate, and then the bands are yellow or orange, on a red ground-color.

A specimen of medium size, from Dominica, has the carapace 31^{mm} long; anterior portion, 13^{mm}; breadth of anterior part, 12.5^{mm}; of posterior part, 26^{mm}; length of eye-stalks, 8^{mm}; length of larger chela 22^{mm}; height, 13^{mm}; length of right chela, 13^{mm}; height, 8^{mm}; propodus of 2d left ambulatory leg, 13^{mm} long; 7.5^{mm} wide; dactylus, 20^{mm} long; 5^{mm} wide at base.

A larger specimen has the left chela, 25^{mm} long; 15^{mm} high; 10^{mm} thick; palm above, 13^{mm}; dactylus, 13^{mm}.

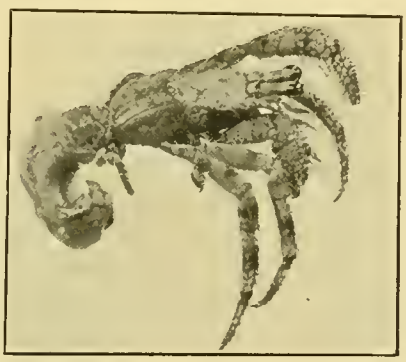


Figure 59.—*Dardanus venosus.* Young, from Bermuda, about $\frac{4}{5}$ nat. size.

The carapace of a small specimen preserved for a short time in formol is pale yellow, with a bright purple median area anteriorly, and a branchial patch of the same on each side, and bands of the same color at the bases of the legs and on the middle of the eye-stalks. The chelipeds are orange, finely reticulated with bright red lines, the reticulations enclosing the whitish tubercles. The second leg on the left side is larger and has on its outer side a median row of bright purple rounded tubercles on the two distal segments, and an outer sublateral row of smaller ones of the same color; the four distal segments of the legs have each a wide band of dark red.

The left chelipeds and second ambulatory leg are covered with fan-shaped groups of plumose hairs, mostly dark red, but some are whitish. Tips of the digits black and spoon-shaped. The left chela is the larger, compressed, and covered with coarse granules. This is from Bermuda, fig. 59.

This species appears to be rare in Bermuda. We obtained one specimen in 1898; another in the Yale Museum was collected by Dr. F. V. Hamlin about 1877. Its range is from Florida to Brazil. Porto Rico (Benedict as *insignis*); ? Maceio and Rio Goyanna, Brazil, on reefs (Rathbun as *insignis*).

About a dozen good specimens of this conspicuously colored species were obtained at Dominica Island by A. H. Verrill, in 1906 (Yale Mus.). They were taken in baited fish-traps in 10 to 25 fathoms. They occupied shells of *Triton variegatus*, *Murex*, and half-grown *Strombus gigas*.

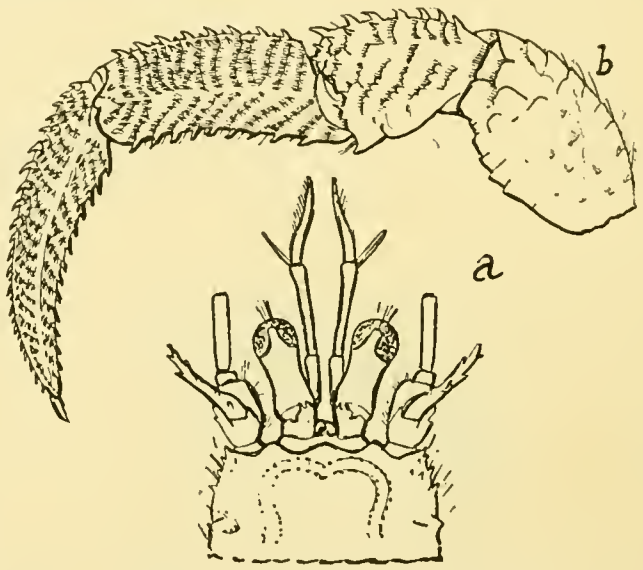


Figure 60.—*Dardanus insignis; a*, anterior part of carapace and appendages enlarged; *b*, distal part of 2d ambulatory leg of left side, more enlarged. After Saussure. See also pl. xxvi.

This species is pretty closely allied to *D. insignis*, but is easily distinguished by the armature of the chelæ and second left ambulatory leg. The eye-stalks of the latter are also shorter (see fig. 59), not reaching to the end of the antennal acieulum, and the ocular scales are different in form. In *D. insignis* the second left ambulatory leg has no median carina on the outer surface (see fig. 59, and Plate xxvi, 4, 5), the oblique ridges and long rows of small tubercles curve backward and meet in "herring-bone" fashion along the convex middle line, on the propodus, but are interrupted by a groove on the dactylus; they are armed with appressed plumose hairs, as in *D. venosus*.

But, unlike the latter, this has also many short, curved, or convex ridges on the carpus and distal part of the merus externally, similarly furnished with appressed hairs; other similar, curved ridges are on the inner surface of the propodus and dactylus, above and below.

It is also more yellow in color and more uniform, without conspicuous bands of red on the legs, and without the red reticulated lines.

Two large specimens of *D. insignis* obtained at Dominica I., in 1906, by A. H. Verrill, are in the Yale Museum. They occupy shells of *Triton variegatus*.

They were taken in fish-traps, in 10 to 25 fathoms, associated with *D. venosus*. The latter was much more common. Saussure's type was from Guadeloupe.

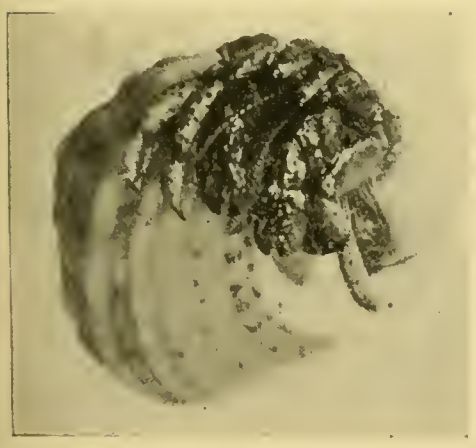
Clibanarius tricolor (Gibbes) Stimp. *Tricolored Hermit-Crab. Blue Hermit-Crab.*

Pagurus tricolor Gibbes, Proc. Amer. Assoc. Adv. Sci., iii, p. 189, 1850.
Clibanarius tricolor Stimpson, Proc. Acad. Nat. Sci., Philad., p. 234 [72], 1858. Rankin, op. cit., p. 239, 1900 (Bahamas); vol. xii, p. 535 (Bermuda). Benedict, Anom. Crust. Porto Rico, p. 142, pl. vi, fig. 2, 1901 (descr.).

Figures 61, 62, 63.

This is a small and very abundant species easily distinguished from all others by its remarkable coloration, in which blue predominates.

61



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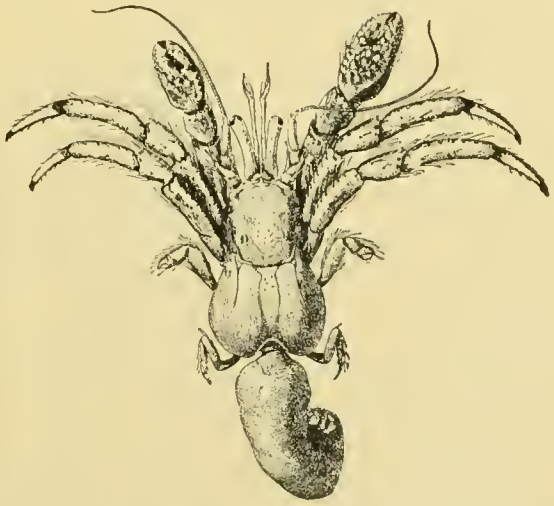

Figure 61.—*Clibanarius tricolor* in a shell of *Modulus*, × about 4 times. Phot. A. H. V.

Figure 62.—The same, much enlarged, after Benedict.

The carapace and eye-stalks are generally bright blue; the antennæ are annulated with bright orange; chelipeds dark olive-green and brown, irregularly spotted with blue, orange, and white; the chelæ

are lighter olive with more numerous spots on the palm, becoming paler or yellowish green distally and on the digits, with the granules white. The ambulatory legs are bright blue, with about four orange or bright yellow bands, at the articulations on the proximal end of the segments, each yellow band preceded by a dark blue band;

Figure 63.—*Clibanarius tricolor*, ×2. Phot. A. H. V.

dactyls bright orange at base, followed by pale orange or whitish, and covered by small bright orange spots; tips of digits black, excavate within. Several variations were noticed. One differed from all others in having no blue color, except the blue ring that precedes the orange band on the legs, but the legs had the usual round orange spots. The chelæ were orange red with white granules and black tips.

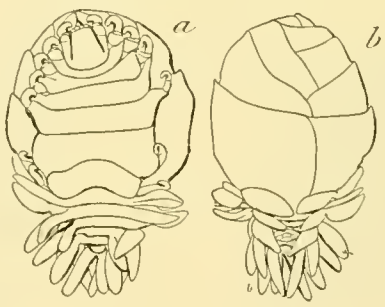

Figure 64.—*Stegias clibanarii*, female, much enlarged; *a*, ventral; *b*, dorsal view. After Richardson.

It is very abundant at Bermuda, among rocks and in tide pools at low-tide. It occupies many kinds of small gastropod shells, such as *Cerithium*, *Modulus*, *Littorina*, *Neritina*, *Anachis*, *Columbella*, *Natica*. Frequently it takes possession of various land shells, commonly washed ashore. It is sometimes infested by a parasitic isopod crustacean (*Stegias clibanarii* Richardson).*

* Proc. U. S. Nat. Mus., vol. xxvii, p. 59, 1904; Monograph of Isopods of N. America, p. 586, figs. 580, *a*, *b*, 1905.

Some of the specimens taken in June and July, 1903, by the members of the Biological Station, carried eggs.

Its range is from Florida to the Antilles. Porto Rico (Benedict); Bahamas (Rankin).

Clibanarius Verrillii Rathbun. *Spotted Hermit-Crab.*

Clibanarius Verrillii M. J. Rathbun, Amer. Journ. Science, ser. iv. vol. xi, p. 328, 1901. Verrill, these Trans., xi. p. 18, pl. viii, figs. 2, 3, 1901.

Plate XXVII, Figure 5. Plate XXVIII, Figure 6.

The following description was furnished by Miss Rathbun several years ago:

"The anterior or hard part of the carapace is a little longer than wide. The median projection of the front is moderately prominent, greater than a right angle; the lateral projections of the front are slightly marked and are broadly rounded. The sides of the carapace diverge posteriorly. The eye-scales are narrow-triangular and are tipped with a short spine. The eye-stalks are very slender and nearly as long as the anterior part of the carapace; they reach to the middle of the antennular flagella. The antennal aciele is slender and reaches to the middle of the last joint of the peduncle; the joint ends a little beyond the middle of the eye-stalk; the flagellum is about twice as long as the eye-stalk."

"The chelipeds are similar in shape but noticeably unequal, the propodus of the right being $\frac{5}{6}$ the length of the left. The distal margin of the carpus of both chelipeds is in line with the end of the eyes. The merus of the larger cheliped is two-thirds as high as long; its outer surface is marked by a few short, faint rugose lines; the upper margin is similarly rugose. The carpus is furnished with rough granules above and along the distal margin; there is a large tubercle on the outer surface. The palm is subrectangular, about equally long and high; upper margin convex. The margins are rough with granules; the outer surface is nearly smooth. Both fingers are stout and deflexed, and gape widely; the inner margins are very unevenly toothed; the upper margin of the dactylus is bordered by two rows of sharp granules. The fingers are excavated at the tips, which are white.

The smaller cheliped differs not only in being shorter and narrower, but in having the upper margin of the carpus and propodus cut into stout spines, increasing in size distally. A similar large spine is on the upper margin of the dactylus at the proximal third. The right cheliped is more hairy than the left, with long light hairs.

The propodus of the second pair of feet reaches the extremity of the large cheliped; the third pair reaches about to the middle of the dactylus of the second pair. Both these legs have a small spine at the lower outer distal angle of the merus, and a longer spine at the upper distal angle of the carpus. The dactyli are a little shorter than the propodi. These legs are furnished sparingly with hairs."

Colors.—In formalin a pinkish-white or yellowish-white ground-color with small roundish spots of bright yellowish-red or orange which are most numerous along the upper and distal margins of the segments of the legs, where they tend to form irregular transverse bands. There are four bands on each of the propodal and terminal joints of the second and third pairs of legs; chelæ and eye-stalks spotted with red." (M. J. Rathbun.)

Total length about 40^{mm}. It becomes much larger.

Bermudas, 4 large and 1 small specimen (coll. Dr. F. V. Hamlin); Yale Mus. and U. S. Nat. Mus."

"This species is nearer *Clibanarius* than it is to any other described genus, and while it perhaps possesses all the essential characters of that genus, it differs notably from the usual form of *Clibanarius* in the inequality of the chelipeds."

No locality, except Bermuda, has been recorded for this rather conspicuous species.

Clibanarius hebes Verrill, sp. nov.

FIGURES 65, 66.

Carapace constricted at the cervical suture; front part shield-shaped, longer than broad; anterior edge five-angled; central tooth small, acute, a little more prominent than those at the base of the antennæ, with the intervening margin a little concave; lateral angles very obtuse and farther back; surface glossy, with small scattered punctæ over the middle, becoming larger and raised on slight rough elevations laterally, each bearing one or several hairs; the one next the cervical suture, on each side, is larger in the form of a small low rounded tubercle. Posterior part with marked longitudinal sunken lines and scattered punctæ; the sides hairy. Eye-stalks slender, about as long as the width of the front of the carapace, shorter than its length; eye-scales small, oblique-ovate, pointed, close together. Peduncle of antennulæ nearly as long as eye-stalks. Antennæ longer than ambulatory legs; the acieulum is narrow, tapered, acute at tip, reaching slightly beyond the penultimate joint of the peduncle, fringed on the inner edge and tip with long hairs.

Chelipeds granulated and hairy, nearly equal in size and form; the distal end of the carpus is about even with the ends of the eyes; merus strongly compressed above proximally, and punctate; carpus covered with sharp granules, bearing one or several slender, pale hairs; on upper side they form two rows of larger acute granules; each row ends distally in a small acute denticle. Chelæ not angular, nor tapered, covered all around with rather small, sharp, nearly equal, hair-bearing granules, which tend to form irregular longitudinal rows; their hairs are pale and slender and too few to conceal the granules; the digits, which are blunt and thick, end in broad, evenly rounded, strong, black nails; lateral edges of digits with sharp white denticles. Ambulatory legs rather long, all about equal,

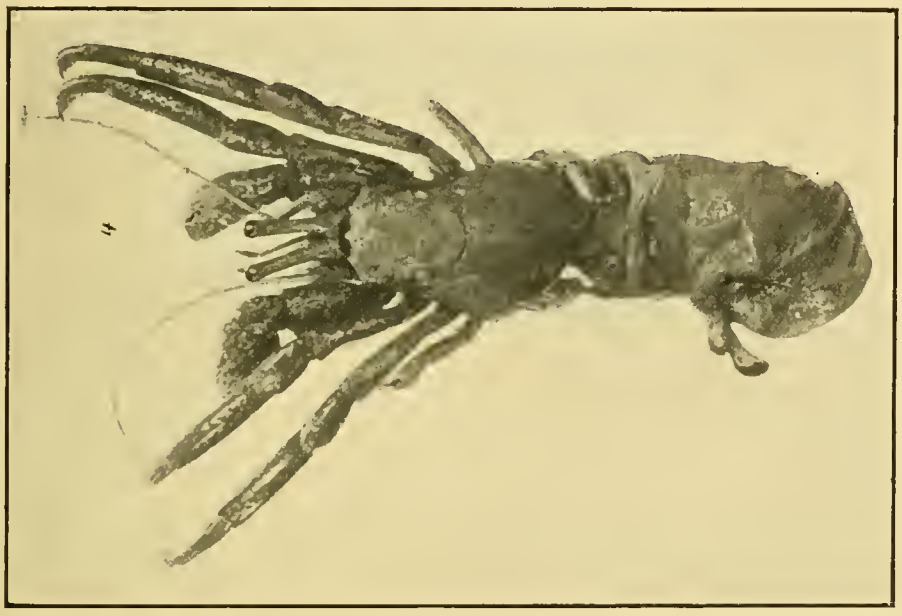

Figure 65.—*Clibanarius hebes.* Type, dorsal view; × about 1¾. Phot. A. H. V.

glossy when dry, covered with small, rather sparce punctæ, which bear few slender, pale hairs; the merus joint of all the legs is compressed.

Color of chelipeds and legs, in alcohol, nearly uniform bright orange; eye-stalks, antennæ and front of carapace a lighter tint of the same. There are no traces of bands, vittæ, nor spots of other colors.

The largest specimen (see figure 65) has the anterior part of the carapace 7^{mm} long; 6^{mm} wide; posterior part 8^{mm} long; 9^{mm} wide; length of eye-stalks, 9^{mm}; length of chelæ, 7^{mm}; diameter, 3^{mm}; length of first ambulatory legs, 26^{mm}.

Two small specimens were collected about 1877, by Dr. F. V. Hamlin (Yale Mus., 3294); a much larger specimen, which is the one figured, was taken in the summer of 1903, by the party of the Bermuda Biological Station, at Coney Island.

Figure 66.—*Clibanarius hebes*, anterior parts, × about 4. Phot. A. H. V.

Geographical Distribution; Origin of the Bermudian Decapod Fauna.

In the preceding article 78 species, subspecies, or named varieties, have been discussed, of which 16 have not been previously recorded from Bermuda. Among these, 9 are described as new.

Of the total number, 72, equal to 93 per cent., have been recorded also from the Florida Keys or the West Indies, or from both, demonstrating the close faunal relations of the two regions. The macruran Decapoda and other groups show similar relations.*

About 53 of the forms (about 68 per cent.) range from Florida to Pernambuco, Brazil, or farther south.

A considerable number, about 25 species, or 31 per cent., extend their range north of Florida to the coast of South Carolina or farther north, the greater portion of these reaching Cape Hatteras. Six or seven reach southern New Jersey.

* The true Macrura of Bermuda (not included in this article) consist of 35 species. Of these 31 species (or 88 per cent.) belong also to the West Indian fauna, a large part of them ranging south to Brazil. Eight of the species are

Two species, *Callinectes sapidus*, *Eupanopeus Herbstii* and its var. *obesus*, range northward to southern New England, as permanent residents.

Several others occur occasionally or sporadically on this coast, being carried northward by the Gulf Stream, or by shipping, but fail to become naturalized so far north, owing to the cold of winter.

It is evident, therefore, that the Bermuda Decapod Crustacean fauna is an offshoot or colony from the West Indian fauna, with only a slight admixture of species from other regions. In this respect the Crustacea agree with the Anthozoa, Mollusca, Echinoderms, Fishes, etc.

Of the total number, only seven species and subspecies are, so far as now known, peculiar to the Bermudas. These are all recently described forms and no doubt most of them will soon be discovered, also, in the West Indies. They are as follows:—

Sesarma Ricordi, var. *terrestris*, nov.
Eupanopeus Herbstii, var. *minax*, nov.
E. bermudensis, var. *sculptus*, nov.
Petrolisthes armatus, var. *pallidus*, nov.
Munida Beanii, sp. nov.
Clibanarius Verrillii Rathbun.
Clibanarius hebes, sp. nov.

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widely distributed free-swimming forms which extend their range even to the Indian and Pacific Oceans ; 3 have been found on the west coast of Africa; 2 on the southern coasts of Europe ; 9 species reach the Carolina coasts ; 1 ranges to New England ; 3 to the Pacific coast of North America.

Of the total number, 4 have not yet been found in the W. Indies, but one of these is a new species, recently discovered, and another is, perhaps, not correctly named.

The marine Isopods, which have been well worked up by Miss Richardson, afford a much larger proportion of species peculiar to Bermuda, so far as now known, but that is largely due to the fact that the West Indian Isopods have not been very thoroughly collected and studied.

Dr. B. W. Kunkel has found, among the 45 species of Bermuda Amphipods, a considerable proportion, 20–21, of Mediterranean species, but the West Indian Amphipods are little known. Twenty species, so far as now known, are peculiar to Bermuda. (Science, vol. xxvii, p. 489, 1908.)

The Bermuda Entomostraca have not been much studied. Among the parasitic species Mr. Chas. P. Wilson has recently identified the following : *Nesipus curticaudis* Dana ; *Pandarus Cranchii* Leach (from shark) · *Lepeophtheirus dissimulatus* Wilson (stomach of hamlet grouper).

In the spring of 1898 we found an undetermined Ostracode Crustacean abundant in the rain-water tanks at Bailey Bay.

The three species of Stomatopoda are all West Indian forms.

The following 24 species range northward on the American coast to or beyond South Carolina, as permanent residents:—

Ocypode arenarius, (to N. Jersey.)
Planes minutus, (to N. Jersey.)
Plagusia depressa.
Cycloxanthops denticulatus.
Eupanopeus Herbstii, (to C. Cod.)
E. Herbstii obesus, (to C. Cod.)
E. occidentalis.
Eurytium limosum, (to N. Jersey.)
Eriphia gonagra.
Callinectes ornatus.
C. sapidus, (to C. Cod.)
Portunus Sayi.
Achelous anceps.
A. Gibbesii.
A. spinimanus, Smithii.
A. Sebæ.
A. Ordwayi.
A. depressifrons.
Stenorhynchus sagittarius.
Podochela Riisei.
Mithrax forceps.
Macrocœloma trispinosum.
Calappa flammea.
Petrolisthes armatus.

Several of the species, mostly grapsoids, are found in most, or all, tropical seas, as well as in the West Indies. They are as follows:—

Grapsus grapsus.
Geograpsus lividus.
Pachygrapsus transversus.
Planes minutus.
Plagusia depressa.
Perenon planissimum.
Domecia hispida.
Petrolisthes armatus.

Of these the most widely distributed is probably *Planes minutus*, which, in the Atlantic, ranges from Nova Scotia to the Straits of Magellan, and in the Pacific from California to New Zealand, etc.

Nearly all the widely distributed species, included in the last list, are found on the West Coast of Africa. But some additional species, common to Bermuda and the W. Indies, are also found on the West African coast. Namely :

Goniopsis cruentatus
Callinectes marginatus, larvatus
Stenorhynchus sagittarius
Calappa flammea
C. gallus, galloides
Hippa cubensis

On page 313, *Cardisoma guanhumi* is also given as occurring in West Africa. Stimpson, Ortmann and other writers have recorded it from there, but Miss Rathbun (1900) places all such records under *C. armatum* Herkl. The Pacific Coast record is also probably erroneous.

Probably the locality, Ascension I., given for *Gecarcinus lateralis*, on p. 310, is erroneous, the species found there being *G. lagostoma* M.-Edw.

Aside from the widely distributed grapsoid crabs, found in all tropical seas, very few of the Bermuda species are found on the Pacific coasts of Central and North America. But many others are represented there by closely allied species or subspecies.* The species that have been considered identical or distinguishable only as varieties by recent good authorities are as follows :

Goniopsis cruentatus	**Percnon planissimum*
**Grapsus grapsus*	**Domecia hispida*
**Geograpsus lividus*	*Epialtus bituberculatus* (varieties)
**Pachygrapsus transversus*	**Calappa gallus* (varieties)
**Planes minutus*	*Cycloës Bairdii* (varieties)
**Plagusia depressa*	**Petrolisthes armatus*

Those preceded by an asterisk are circumtropical.

It is well known that a considerable number of species of Mollusca, Echinoderms, Anthozoa, etc., as well as Crustacea, are common to West Africa, Brazil, and the West Indies. Such species may have originated on the African coast and from thence migrated across the Atlantic to South America, and thence northward to the W. Indies, Florida, and Bermuda, during recent geological times. All the species of Decapod Crustacea having this wide range exist for a considerable length of time as free-swimming larval forms, in the zoëa and megalops stages. These larval forms may be carried long distances by the prevailing oceanic currents, especially in the regions of the trade winds.

It is scarcely admissible to suppose that they could have traveled in the opposite directions, against the currents, unless by human agency, in recent times.

Many Crustacea, including the higher and more active forms, especially the grapsoid and cancroid crabs, are in the habit of hiding among the clusters of barnacles, etc., attached to the bottoms of vessels, and in this way they may be carried across the oceans in any direction, so long as the temperature of the water is suitable for their existence. In this way many tropical species reach the New England coast in summer, but die out during the winter.

* Mr. Walter Faxon has given, in parallel columns, comparative lists of the closely related species occurring on the two coasts. See Mem. Mus. Comp. Zoology, vol. xviii, pp. 235–237, 1895.

Several species of crabs and shrimps habitually live among floating *sargassum*, or attached to floating driftwood. This is the case especially with *Planes minutus*, *Portunus Sayi*, and some others. That they have migrated to Bermuda in this way is very evident, for they do so constantly, day by day, at the present time.

But the majority of the species common to Bermuda and the West Indies do not have such habits, and must have migrated northward in the free-swimming larval stages. The direction of the Gulf Stream and prevailing wind currents are favorable for the transportation of free-swimming animals from the Bahamas, Cuba, etc., to the Bermudas.

On the other hand, very few if any strictly East American species have established themselves in the Bermudas, notwithstanding the constant passage of vessels in that direction for nearly three hundred years. Perhaps the temperature of the Gulf Stream is too high to allow such species to be carried across it, or they may not be able to endure the summer temperature of the Bermuda waters.

There are, likewise, no Decapod species of European or Mediterranean origin known in the Bermuda fauna, though such are known to occur in other orders, especially in those groups that habitually cling to the foul bottoms of vessels.

The chances of many species being introduced into Bermuda waters by this means have been unusually good, for the great dry dock has existed at the naval station for many years. And long before that, even from the first settlement, the sheltered harbors and beaches of Bermuda have been favorite places for the beaching of vessels to clean their bottoms.

It would be of great scientific interest, as well as evident economical benefit, to experiment with the introduction of edible East American and West Indian crustacea that do not now exist at the Bermudas. Among those that might succeed are the large Southern Rock Crab (*Menippe mercenaria*); the West Indian Rock Crab (*Carpilius corallinus*); the southern variety of the Edible Blue Crab (*Callinectes sapidus*), and many others. Probably their fertilized eggs could be transported far more easily than the adults, and in vastly greater numbers. With suitable arrangements at the new Bermuda Biological Station, such eggs could easily be hatched and the young liberated in great numbers, in suitable places.

It would probably be useless to attempt to introduce those species that are restricted to our coast north of Cape Hatteras, such as the common lobster, but there seems to be no reason why any species

from the Carolina coasts or the Florida Keys should not flourish in Bermuda if once introduced there in considerable numbers and protected from their enemies at first.

Probably hundreds of species have been accidentally carried there, singly or in small numbers, in past times, which have failed to establish themselves, either because they became too far separated to find their mates at the breeding season, or because they were too soon eaten up by voracious fishes. Yet a single female crab, carrying fertilized eggs, might succeed in introducing the species, for their eggs often amount to 5,000, or even 10,000 at one time. Aside from edible species, the introduction of the smaller kinds would afford a large additional supply of food for useful fishes, and thus benefit the fisheries.

Probably there is no locality in the world so well adapted by nature for experiments in the naturalization of marine animals as Bermuda. There are here numerous deep basins and ponds, of pure sea water, due to fallen caverns, which have subterranean connections with the sea through pores and crevices in the porous limestone, by which the sea water is constantly renewed. In such places large numbers of marine creatures could be protected and allowed to breed till well naturalized, and numerous enough to be safely liberated. The equable temperature of the climate is also particularly favorable for such experiments. That any given species of the West Indian marine fauna is not now found in Bermuda does not prove that it is not able to live there, but rather that it has lacked the opportunity or means of arriving there.

There is a large field open here for enterprising naturalists and biologists.

Figure 67.—*Sesarma Ricordi*, var. *terrestris*, nov. Bermuda; × 1¼. Phot. A. H. Verrill.

BIBLIOGRAPHY.

The following list is intended to include only the later works that relate to the Bermuda species, especially those in which special mention is made of specimens from Bermuda. But as the West Indian species are largely the same as the Bermudian, works relating exclusively to West Indian localities have also been included.

The earlier works and those of a general character are sufficiently indicated in the synonymy of the species.

Benedict, James E.—Notice of the Crustaceans collected by the U. S. Scientific Expedition to West Africa, Proc. U. S. Nat. Mus., xvi, pp. 535–541, 1893, No. 949.

This article includes species taken at Barbados, Cape Verde Is., and Azores, as well as those from W. Africa. A number of the species named are found also in Bermuda.

Benedict, James E.—The Anomuran Collections made by the Fish Hawk Expedition to Porto Rico. Bulletin U. S. Fish Commission for 1900, vol. ii, pp. 129–148, pls. iii–vi, 1901.

Contains descriptions of all the Porto Rico genera and species, several of which are found also in Bermuda.

Benedict, James E. and **Rathbun, Mary J.**—The Genus Panopeus, Proc. U. S. Nat. Mus., vol. xiv, No. 858, pp. 355–385, pls. xix–xxiv, 1891.

A monographic revision of all the species of this group, with distribution.

Cole, George Watson.—Bermuda in Periodical Literature, with occasional reference to Other Works. A Bibliography; pp. 275, with portrait of the author and 8 fac-simile reproductions of the title-pages of ancient works on Bermuda, 1907. Published by the author, Riverside, Conn.

Includes notices of all works relating to Bermuda collections of Crustacea, usually with lists of the new species and new additions to the Bermuda fauna. (Total number of titles given is 1382.)

Edwards.—See **Milne-Edwards.**

Gibbes, Lewis R.—On the Carcinological Collections of the United States, Proc. Amer. Assoc. Adv. Sci., vol. iii, pp. 167–201, 1850.

Godet, Theod. L.—See *Verrill*, Bermuda Is., i, p. 456, for review.

Henderson, R. J.—Reports of the Voyage of the Challenger; Zoology. Report on the Anomura, vol. xxvii, 1888.

Records only two shallow-water species from Bermuda. Also two deep water species: *Parapagurus abyssorum* Edw. and *Munidopsis serratifrons* Edw., both from 1075 fath.

Hurdis, John L.—Rough Notes and Memoranda relating to the Natural History of the Bermudas (edited by his daughter, H. J. Hurdis). London: R. H. Porter, 1897, 8vo, 408 pp.

This work relates mainly to the birds. The observations and notes were mostly made from 1841 to 1853. On p. 361 is a brief list of Crustacea (10 species) with their common names, and partly with Latin names, many of which are incorrect. The species are as follows:—Land Crab (*Gecarcinus ruricola*)= *G. lateralis;* "Edible Crab (*Lupa diacantha*) of the United States," probably= *Callinectes ornatus;* Spider Crab (*Libinia canaliculata*), probably = *Mithrax* sp. ?: Long-tailed Crab, Stump, or French Lobster (*Scyllarus equinoctialis*) probably correct, now *Scyllarides;* Soldier or Hermit Crab (*Pagurus* ———), probably *Cenobita diogenes* was referred to; Cray Fish called "Lobster" (*Palinurus* ———),=*P. argus.* "It is of large size and fairly abundant." Sand Bug (*Hippa* ———)=*Hippa cubensis;* Common Prawn (*Palæmon serratus*) probably=*Penæus braziliensis*, body 5.3 inches long; Common Shrimp (*Palæmon vulgaris*), = *Palæmon affinis* probably; Coral Crab = *? Mithrax cornutus;* ("*Pericera cornuta*"),=*Stenocionops furcatus.* "Taken in a lobster pot."

His notes on the size, colors, and spines of the "Coral-crab" indicate a large red spiny *Mithrax*, probably *M. cornutus* (possibly *M. spinosissimus*). He gives some descriptive notes in regard to the large Prawn, stating that it has 6 chelate legs, but none for the "Shrimp." The presence of six chelate legs and long rostrum shows that his prawn was a *Penæus. P. braziliensis* is the only Bermuda species that grows to the size he gives. The "shrimp" is described as abundant in tide pools. This would still apply to *Palæmon affinis.*

It is possible that the *Callinectes sapidus*, or "Edible Crab of the U. S," did occur commonly at that time, but at that date the abundant *C. ornatus* had not been separated from it even by naturalists. His *Libinia* is, of course, very doubtful (see above, p. 396). No species much resembling it is now known from Bermuda.

Jones, J. Matthew.—The Visitors Guide to Bermuda. 12mo, 150 pp. Halifax, London, and New York, 1859.

A correct list of three species of Crustacea on page 145.

Kingsley, J. S.—List of Decapod Crustacea of the Atlantic Coast, whose range embraces Fort Macon, Proc. Acad. Nat. Sci. Philadelphia for 1878, pp. 316–328 (1878); 329–330 (1879); 1878–79.

Includes a number of Bermuda species with notes on their distribution, etc.

Kingsley, J. S.—Notes on North American Crustacea, Proc. Boston Soc. Nat. Hist., vol. xx, pp. 145–160, 1879.

Contains description of *Mithrax hirsutipes*, nov. sp.

Kingsley, J. S.—On a Collection of Crustacea from Virginia, North Carolina, and Florida, Proc. Acad. Nat. Sci. Philadelphia for 1879, vol. xxi, pp. 383–427, 1880.

A very useful paper, including many of the Bermuda species.

Kingsley, J. S.—Carcinological Notes, No. iii, Revision of the Genus Ocypoda, Proc. Acad. Nat. Sci. Philadelphia for 1880, pp. 179–186, 1880.

Kingsley, J. S.—Carcinological Notes, No. iv, Synopsis of the Grapsidae, Proc. Acad. Nat. Sci. Philadelphia for 1880, pp. 187–224.

Martens, E. Von.—Ueber Cubanische Crustaceen, Arch. fur Naturg., ii, p. 147, 1872.

Miers, Edward J.—On the Classification of the Maioid Crustacea or Oxyrhyncha, with a synopsis of the families, subfamilies, and genera, Journ. Linn. Soc. London, vol. xiv, pp. 634–673, pls. xii, xiii, 1879.

Miers, Edward J.—Reports of the Voyage of the Challenger. Zoology. Report on the Brachyura, vol. xvii, 1886.

Includes a small number of common species collected at Bermuda, with descriptions (see above, p. 301). Also a new deep water species: *Geryon ? incertus*, 435 fathoms.

Milne-Edwards, Alphonse.—Etudes zoologiques sur les Crustacés récentes de la famille des Portuniens, Arch. Mus. Hist. Nat., Paris, vol. x, pp. 309–428 + 2 pp. addenda, plates xxviii–xxxviii, 1861.

A monograph of the Portunidæ.

Milne-Edwards, Alphonse.—Etudes zoologiques sur les Crustacés récentes de la famille des Cancériens, Nouv. Arch. Mus. Hist. Nat. Paris, vol. i, pp. 177–308, pls. xi–xix, 1865.

Milne-Edwards, Alphonse.—Mission Scientifique au Mexique et dans l'Amérique Centrale, Recherches Zoologiques publ. sur la Direction de **M. H. Milne-Edwards**. Part V. Etudes sur les Xiphosures et les Crustacés Podothalmaires par M. Alphonse Milne-Edwards. Paris, 1873–1880. Large 4to, 368 pages, with 61 plates.

This very extensive work on the Brachyura includes all the West Indian species of the families treated, known up to the time of publication. Most of the species are well figured, with many details of structure.

It was published in numbers. The 2d, which begins the systematic part, is dated, on the original cover, 1873; the 3d is 1875; 4th, 1878; 5th, 1879; 6th, 1879; 7th, 1880; 8th, 1880.

It is the most important and useful work relating to the Brachyura of the West Indian region, both on account of the large number of figures and the very good descriptions. The Pacific coast species are also included. This book is now rare and expensive.

Ordway, Albert.—Monograph of the Genus Callinectes, Journ. Boston Soc. Nat. Hist., vol. vii, pp. 567–583.

For a biographical sketch of the author, see above, p. 384.

Ortmann, Arnold.—Decapoden und Schizopoden der Plankton Exped., Bd. ii, 1893.

Records nine Bermuda species.

Rankin, W. M.—The Northrop Collections of Crustacea from the Bahamas, Annals N. York Acad. Sci., xi, pp. 225–254, pl. xxix, xxx, 1898.

Rankin, W. M.—The Crustacea of the Bermuda Islands, with notes on the Collection made by the New York University Expeditions of 1897 and 1898. Annals New York Acad. Science, vol. xii, No. 12, pp. 521–548.

For a notice of this useful paper, see above, p. 301. It includes the species collected by Mr. G. Brown Goode.

Rathbun, Mary J.—Catalogue of the Crabs of the Family Maiidæ in the U. S. National Museum, Proc. U. S. Nat. Mus., vol. xiv, No. 927, pp. 63–103, pls. iii–viii, 1891.

Rathbun, Mary J.—Catalogue of the Crabs of the Family Pericerida in the U. S. National Museum, Proc. U. S. Nat. Mus., vol. xv, No. 901, pp. 231–277, pls. xxviii–xl, 1892.

Rathbun, Mary J.—Notes on the Crabs of the Family Inachidæ in the U. S. National Museum, Proc. U. S. Nat. Mus., vol. xvii, No. 984, pp. 43–75, 1894.

Rathbun, Mary J.—The Genus Callinectes, Proc. U. S. Nat. Mus., vol. xviii, No. 1070, pp. 349–375, pls. xii–xxviii, 1896.

A monographic treatment of the genus, with full descriptions and synonymy.

Rathbun, Mary J.—Synopsis of the American Sesarmæ, with description of a new species, Proc. Biol. Soc. Washington, vol. xi, pp. 89–92, 1897.

Descriptions of previously known species, except *S. Miersii* a Bermuda species, are given only in the form of an analytical table.

Rathbun, Mary J.—The Brachyura of the Biological Expedition to the Florida Keys and the Bahamas in 1893. Bulletin from the Laboratories of Natural History of the State University of Iowa, vol. iv, No. 3, pp. 250–294, pls. i–ix, 1898.

In this work 127 species are enumerated; many new species are described, and various genera and species are revised or renamed. Many of the species are found also at Bermuda. The general distribution is not given, and but few descriptions of previously known species.

Rathbun, Mary J.—Synopses of North American Invertebrates. VII. The Cyclometopous or Cancroid Crabs of North America, Amer. Naturalist, xxxiv, No. 398, pp. 131–143, Feb., 1900. X. The Oxyrhynchous and Oxystomatous Crabs of North America, op. cit., No. 402, pp. 503–520, June, 1900. XI. The Catemetopous or Grapsoid Crabs of North America, op. cit., No. 403, pp. 583–592, July, 1900.

A few Bermuda species are included. The analytical tables are very useful.

Rathbun, Mary J.—The Decapod Crustaceans of West Africa, Proc. U. S. Nat. Mus., xxii, pp. 271–316, 1900.

Some of the species described are recorded as found also at Bermuda.

Rathbun, Mary J.—Results of the Branner-Agassiz Exp. to Brazil, Proc. Wash. Acad. Sci., ii, pp. 133–136, pl. viii, 1900.

Many of the species are found also in Bermuda.

Rathbun, Mary J.—The Brachyura and Macrura of Porto Rico. From the U. S. Fish Comm. Bulletin, for 1900, vol. ii, pp. 1–137, pl. i, ii, 1901.

In this excellent report, brief but clear descriptions are given of all the genera and species, as well as analytical tables of the genera and higher groups. (See also p. 302, above.) Very few species are figured. All the species are named that had been previously recorded from Bermuda, with their general distribution.

Rathbun, Mary J.—Some Changes in Crustacean Nomenclature, Proc. Biological Soc. Washington, xvii, pp. 169–172, 1904.

Proposes a number of radical changes in crustacean nomenclature based on suggestions of Fredericus Weber, 1795, in a rare and obscure work, in which the generic names are only given by name, with no definitions, but with a statement that they would be published later by Fabricius.

Stebbing, Rev. T. R. R., in Linn. Soc. Journ., xxix, p. 325, has criticised her conclusions, on the ground that the generic names were only mere suggestions of what was to be published later by Fabricius, and on that account had no claims to recognition until actually published and defined by him. This seems to be a common sense view of the case, for this advance and erroneous publication of his MSS. names appears not to have been authorized by Fabricius.

Rathbun, Richard.—The Fisheries and Fishery Industries of the United States, Crustaceans, pt. v, pp. 763–830, pls. cclx–cclxxv, in separate volume, 1884.

Saussure, Henrie de.—Mémoire sur divers Crustacés nouveaux des Antilles, et du Mexique, Mémoirs Phys. et Hist. nat., Geneva, vol. xiv, pp. 419–494, + index, pls. i–iv, 1858.

Smith, Sidney Irving.—Notes on New or Little-known Species of American Cancroid Crustacea, Proc. Boston Soc. Nat. Hist., vol. xii, pp. 274–289, 1869.

One species from Bermuda is recorded; several are fully described.

Smith, Sidney I.—Notice of the Crustacea collected by Prof. C. F. Hartt, on the Coast of Brazil in 1867. These Trans., vol. ii, pp. 1–42, pl. i, 1869.

Five species from Bermuda (coll. J. M. Jones) are recorded. A general list of Brazilian Crustacea, with their distribution, is given. Many of the species are well described.

Smith, Sidney I.—Notes on American Crustacea, No. 1, Ocypodoidea, Trans. Conn. Acad. Sci., vol. ii, pp. 113–176, pls. ii–v, 1870.

Smith, Sidney I.—The Megalops stage of Ocypoda, Amer. Journ. Science, vi, p. 67, July, 1873.

Smith, Sidney I.—Occasional occurrence of tropical and subtropical species of Decapod Crustacea on the Coast of New England, Trans. Conn. Acad. Sci., vol. iv, pp. 254–267, 1880.

Gives details of occurrence of 7 Bermuda species of crabs on the New England coast, due to influence of Gulf Stream, with full synonymy of some of the species, measurements, and notes on variation, etc.

Smith, Sidney I.—Preliminary notice of the Crustacea dredged in 64–325 fathoms, off the South Coast of New England by the U. S. Fish Commission in 1880, Proc. Nat. Museum, Washington, vol. iii, pp. 413–452, for 1880, Jan., 1881.

Smith, Sidney I.—Report on the Decapod Crustacea of the Albatross Dredgings off the East Coast of the United States during the Summer and Autumn of 1884. Rept. U. S. Commissioner of Fish and Fisheries for 1885, pp. 605–705, 1886.

Includes several species that are found in Bermuda.

Stone, Witmer, in **Heilprin, Angelo.**—The Bermuda Islands, Crustacea on pp. 146–149. Philadelphia, 1889.

Enumerates 26 species of Crustacea, of which 7 are *Macrura*. A few are incorrectly named; none are described. (See also p. 300, above.)

Stimpson, William.—Notes on North American Crustacea, No. I, Ann. Lyc. Nat. Hist. New York, vol. vii, pp. 49–93, pl. i, 1859.

Stimpson, William.—Notes on North American Crustacea, No. II, Ann. Lyc. Nat. Hist. New York, vol. vii, pp. 176–246, pls. ii, v.

Stimpson, William.—Notes on North American Crustacea in the Museum of the Smithsonian Institution, No. III, Ann. Lyc. Nat. Hist. New York, vol. x, pp. 92–136, 1871.

In this and the two preceding works, large numbers of new species and genera are described from Florida and the West Indies. No Bermuda localities are given.

Stimpson, William.—Preliminary Report on the Crustacea Dredged in the Gulf Stream in the Straits of Florida, by L. F. de Pourtalès, Assist. U. S. Coast Survey, pt. i, Brachyura, Bull. Mus. Comp. Zool., vol. ii, pp. 109–160, 1871.

Includes descriptions of large numbers of new West Indian genera and species, mostly from deep water.

Verrill, Addison E.—Additions to the Crustacea and Pycnogonida of the Bermudas, Trans. Conn. Acad. Sci., vol. x, pt. ii, pp. 573–582, pls. lxvii–lxix, 1900.

Verrill, Addison E.—Additions to the Fauna of the Bermudas from the Yale Expedition of 1901, with Notes on Other Species. Op. cit., vol. xi, pp. 15–62, pl. i–ix, 1901.

Verrill, Addison E.—The Bermuda Islands, vol. i, pp. 37, 53, 289, 293–296, figs. 22*a*, 56, 57, 250, pl. xciv, fig. 1, 1903. A repaged reprint (with additions) from Trans. Conn. Acad. Science, vol. xi. See pp. 449, 464, 701, 705–708, figs. 22*a*, 56, 57, 250, pl. xciv, 1903.

A second edition, with a supplement, seven additional plates, and a map, 1907. Published by the author, New Haven, Conn.

Observations on the early history and habits of *Panulirus argus*, *Cenobita diogenes*, *Gecarcinus lateralis*, etc.

Verrill, Addison E.—Geology and Paleontology of Bermuda, Trans. Conn. Acad., vol. xii, pp. 158, 179, 196, 197, fig. 60, 1906.

Discusses occurrence of *Cenobita diogenes* as a fossil.

Von Martens, see **Martens.**

Willemoes-Suhm, R. Von.—On some Atlantic Crustacea from the Challenger Expedition, Trans. Linn. Soc. London, ser. 2, vol. i, pp. 23–29, Sept., 1875.

Refers to the land crabs and to the Mangrove Crab, *Goniopsis cruentatus* (habits); mentions taking personally several crabs "allied to *Boscia*" (=*Pseudothelphusa*). Describes *Nebalia longipes*, p. 26.

Young, Chas. G.—The Stalk-eyed Crustacea of British Guiana West Indies, and Bermuda, London, 1900, xix + 514 pp., 7 colored pls.

Contains brief description of many Bermuda species. Twenty-three species previously recorded by others, are attributed to Bermuda.

EXPLANATION OF PLATES.

All the figures, unless otherwise stated, have been made from photographs of the subjects by Mr. A. Hyatt Verrill. In nearly all cases Bermuda specimens were used for this purpose. Unless the locality is otherwise given, it is to be understood as Bermuda.

Plate IX.

Figure 1.—*Cardisoma guanhumi;* dorsal view of a half-grown male from Bermuda; ⅔ nat. size.

Figures 2, 3.—*Ocypode arenarius*, male and female; about ¾ nat. size, resting on Bermuda shell-sand.

Plate X.

Figure 1.—*Plagusia depressa*, dorsal view of female, about ⅔ nat. size.

Figure 2.—*Sesarma Ricordi*, ♀; typical, about 1⅓ nat. size.

Figure 3.—*Percnon planissimum*, ♀; about 1⅓ nat. size.

Figure 6.—*Grapsus grapsus.* Large chela of male; ¾ nat. size.

Plate XI.

Figure 1.—*Goniopsis cruentatus;* about ¾ nat. size.

Figure 2.—*Grapsus grapsus;* about ⅔ nat. size.

Figure 3.—*Sesarma Ricordi*, var. *terrestris*, nov. Co-type; × about 2.

Plate XII.

Figure 1.—*Cyclograpsus integer*, dorsal view of a West Indian specimen, about nat. size.

Figure 2.—*Pachygrapsus gracilis*, ♀, dorsal view of a Bermuda specimen, × 1½.

Figure 3.—*Pachygrapsus transversus*, ♂, × about 1½.

Figure 3*a*.—The same ♀, × about 1½; 3*b*, large chela, somewhat enlarged.

Figure 4.—*Percnon planissimum*, large chela of male, slightly enlarged; *h*, the tuft of hair on inner side of merus.

Figure 4*a*.—*Goniopsis cruentatus;* large chela of male, 1⅓ nat. size.

Figure 5.—*Sesarma Miersii*, dorsal view of carapace, × about 2.

Plate XIII.

Figures *a–j'*.—*Planes minutus*, dorsal view of 36 specimens selected from a large lot taken at one time and place at Bermuda, to show variations in form and color, about ¾ nat. size.

Plate XIV.

Figure 1.—*Lobopilumnus Agassizii*, var. *bermudensis*, ♂ ; No. 3031, from Bermuda ; × about $1\frac{1}{6}$.

Figure 2.—The same, No. 3123 ; female with eggs : central view ; enlarged about $1\frac{1}{2}$.

Figure 3.—*Eriphia gonagra*, ♀ ; about $1\frac{1}{5}$ nat. size.

Figure 4.—*Xanthodius parvulus*, ♂ ; dorsal view ; × $1\frac{2}{3}$.

Figure 5.—*Liomera dispar*, ♂ ; No. 3176, dorsal view of a Bermuda specimen ; × about $1\frac{1}{2}$.

Figure 6.—*Platypodia spectabilis*, ♂ ; dorsal view of a fresh specimen from Bermuda ; about nat. size.

Figure 7.—*Leptodius floridanus*, ♂ , dorsal view ; about nat. size.

Figure 8.—*Cycloxanthops denticulatus*, dorsal view ; about nat. size.

Figure 9.—*Eupanopeus bermudensis*, var. *sculptus* ; nat. size.

Figure 10.—*Eurytium limosum*, dorsal view of a small specimen from Bahia, Brazil, nat. size.

Plate XV.

Figure 1.—*Eupanopeus Herbstii*, var. *obesus*, ♂ ; dorsal view, about nat. size.

Figure 2.—*E. Herbstii*, *minax*, nov., ♂ ; dorsal view of the type from Bermuda; $\frac{9}{10}$ nat. size.

Figure 3.—*E. Herbstii*, ♂ , typical ; from a Bermuda specimen ; × about $1\frac{1}{3}$.

Plate XVI.

Figure 1.—*Eupanopeus serratus*, ♂ ; from Bermuda ; about nat. size.

Figure 2.—*E. occidentalis*, female with eggs, No. 3021, from Bermuda ; × about $1\frac{1}{5}$.

Figure 3.—*E. bermudensis*, var. *sculptus*, nov., ♀ ; × about $2\frac{1}{2}$.

Figure 4.—*E. bermudensis*, ♀ ; No. 3280 ; *a*, carapace : *b*, large chela, × about $2\frac{1}{2}$.

Figure 5.—*E. serratus*, ♂ . No. 3019, carapace ; × about $1\frac{1}{2}$; *b*, large chela of the same.

Plate XVII.

Figure 1.—*Callinectes ornatus*, ♂ ; dorsal view of a fresh Bermuda specimen, about $\frac{2}{3}$ nat. size.

Figure 2.—*C. sapidus*, ♀ ; dorsal view of a fresh New Haven specimen ; about $\frac{1}{2}$ nat. size.

Plate XVIII.

Figure 1.—*Callinectes marginatus*, *larvatus*, ♂ ; dorsal view of a young Bermuda specimen, No. 1903*b* ; × about $1\frac{2}{3}$.

Figure 2.—*Portunus Sayi*, ♂ ; from off New Jersey, No. 4036 ; × about $1\frac{1}{3}$.

Figure 3.—*Achelous Ordwayi*, young ; about nat. size.

Plate XIX.

Figure 1.—*Charybdella tumidula*, dorsal view of a Bermuda specimen, No. 672, F. M.; × about $1\frac{1}{6}$.

Figure 2.—*Achelous Smithii*, No. 4035*b*; cotype, dorsal view; × about $1\frac{1}{10}$; 2*b*, chela of the same, front view. Cotype from off Cape Hatteras.

Plate XX.

Figures 1, 2.—*Achelous anceps*, dorsal view of fresh Bermuda specimens; × about $1\frac{1}{2}$.

Figure 3.—*A. depressifrons*, dorsal view of a fresh Bermuda specimen; × about $1\frac{1}{2}$.

Plate XXI.

Figure 1.—*Portunus Sayi*, ♂, view of ventral side of No. 4036, from off New Jersey; × about $1\frac{1}{3}$.

Figure 2.—*Achelous Smithii*, ventral view of immature female. Cotype No. 4035, from off Cape Hatteras; × about $1\frac{1}{3}$.

Figure 3.—*Callinectus marginatus, larvatus*, ventral view of young male, No. 1903*b*, from Bermuda; × about $1\frac{1}{3}$.

Plate XXII.

Figure 1.—*Stenorhynchus sagittarius*, about $\frac{1}{2}$ nat. size; *a*, frontal area; *b*, outer maxilliped; *c*, sternum; *d*, male abdomen. After A. M.-Edwards.

Figure 2.—*Podochela Riisei*, about $1\frac{1}{2}$ nat. size. After A. M.-Edwards.

Figure 3.—*Macrocœloma subparallelum*, ♂: *a*, dorsal view, about nat. size; *c*, left chela; *d*, ventral surface of male. After A. M.-Edwards.

Plate XXIII.

Figure 1.—*Mithrax depressus*? or *M. hispidus*: young ♂, No. 3019; from Bermuda; × about $2\frac{1}{3}$.

Figure 2.—*Mithrax depressus*, ♀, No. 3265, from Saint Thomas; × about $1\frac{1}{4}$.

Figure 3.—*Mithrax hispidus*, ♀, No. 4058, from Bermuda; × about $1\frac{4}{5}$.

Figure 4.—*Mithrax hispidus*, ♀, No. 4054, immature, from Bermuda; × $1\frac{1}{10}$.

Plate XXIV.

Figure 1.—*Epialtus bituberculatus, bermudensis*, type; × $1\frac{1}{2}$.

Figure 2.—*Mithrax hispidus*, ♀. Under side of No. 4058. See pl. xxiii, fig. 3.

Figure 3.—*Chorinus heros*, ♂; dorsal view; × about $1\frac{1}{2}$. After Cuvier.

Figure 4.—*Mithrax forceps, hirsutipes*; adult male; nat. size.

Figures 5, 6.—The same; young; about nat. size.

Plate XXV.

Figure 1.—*Calappa flammea*; about $\frac{3}{4}$ nat. size.

Figure 2.—*Stenocionops furcatus*, ♂, $\frac{2}{3}$ nat. size, with hairs removed from left side, but with an attached chalinid sponge, which is infested with parasitic polyps of *Parazoanthus parasiticus*. From Dominica; about $\frac{1}{2}$ nat. size.

Plate XXVI.

Figure 1.—*Geograpsus lividus*, ♂, larger chela. × $1\frac{1}{3}$.

Figure 3.—*Calappa gallus, galloides;* dorsal view; about nat. size.

Figure 4.—*Dardanus venosus:* *a*, 2d ambulatory leg of left side; enlarged about $1\frac{3}{4}$; *mm*, merus; *ca*, carpus; *p*, propodite; *d*, dactyl; *b*, *c*, parts of the corresponding leg of *D. insignis*, lettered as before. Photo. from Dominica specimens by A. H. V.

Figure 5.—Portions of the propodite of the same legs as those in fig. 4, more enlarged; *a*, *Dardanus venosus;* *b*, *D. insignis*.

Plate XXVII.

Figure 1.—*Pilumnus spinipes*, dorsal view of male from Bermuda, No. 3119; × $1\frac{9}{16}$.

Figure 2.—*Cycloës Bairdii*, typical form, front view of a cotype from Cape St. Lucas, Gulf of California; × about $1\frac{1}{2}$.

Figure 3.—*Petrolisthes armatus;* about nat. size.

Figure 4.—*Achelous anceps;* dorsal view; × about $1\frac{1}{2}$; *a*, cheliped; *b*, swimming leg.

Figure 5.—*Clibanarius Verrillii*, cotypes; *a*, side view; *b*, dorsal view; about nat. size.

Figure 6.—*Planes minutus;* dorsal view of a fresh specimen; × $1\frac{1}{2}$.

Figure 7.—*Cycloxanthops denticulatus*, dorsal view; natural size.

Figures 8, 9.—*Munida Beanii*, types. Dorsal view of carapace, etc., × about 5.

Plate XXVIII.

Figure 1.—*Albunea oxyophthalma*, side view of a Bermuda specimen; $\frac{3}{4}$ nat. size.

Figure 2.—*Dromidia antillensis;* about nat. size.

Figure 3.—The same. Cheliped of a Brazilian specimen; × about 4.

Figure 4.—*Petrolisthes armatus;* cheliped: × about 4.

Figure 5.—*Parthenope crenulatus;* × about 3.

Figure 6.—*Calcinus sulcatus;* slightly enlarged.

Figure 7.—*Clibanarius Verrillii*, cotype; slightly enlarged.

Figure 8.—*Trogloecarcinus corallicola*, ♀, partially out of its den in a coral (*Mussa*) from Dominica I.; × about three times. The crab was intentionally placed in a den belonging to an older individual, otherwise but little of it could be seen. Phot. A. H. V.

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Figure 68.—*Platypodia spectabilis* (see p. 336): enlarged. Phot. A. H. Verrill.

ERRATA.

Page 310, line 14, omit Ascension I.
Page 313, line 21, omit West Coast of Africa.
Page 335, line 1, for p. 14, read p. 305.
Page 336, line 13, for lobata, read lobatus.
Page 362, line 7 from bottom, for p. 238, read p. 338.
Page 408, line 8, for fig. 34, read fig. 41.
Page 422, line 10, for *Cancer*, read *Calappa*.

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BY

RUDOLPH SCHEVILL

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VII.—STUDIES IN CERVANTES

BY RUDOLPH SCHEVILL

PERSILES Y SIGISMUNDA

III VIRGIL'S AENEID

a. In Spanish literature before Cervantes.

Having seen that a comparatively small portion of the *Persiles* is patterned after the romance of Heliodorus,[1] we can now proceed to the question, as to what other work of fiction could have influenced Cervantes in his last production. We need not search long among current books of his day, before coming upon another classic, one of unexampled vogue and far-reaching influence in every succeeding age, the *Aeneid* of Virgil. A student of Renaissance literature and of the general culture of the sixteenth century might at once take for granted that Cervantes was acquainted with the main features, at least, of the Latin poem; that he must have turned to it directly and naturally, as to a kind of contemporary *roman d'aventure* may, perhaps, be clearer from what will be set forth in this article.[2]

The influence of the Aeneid on Spanish literature is of importance in any study of fiction preceding the *Persiles,* because the Latin epic was not only maintaining its traditional position as a standard classic among the learned, but had become a part of popular literature somewhat after the fashion of the romance of Heliodorus. While university students mastered the syntax of the foremost of Latin poets, lay readers were enjoying in the vernacular the story

[1] *Modern Philology,* Vol. IV, No. 4 (1907); the present article is the third of a series of studies in the sources of *Persiles y Sigismunda,* the first being an introduction, in the nature of a résume of what has been written on the subject, and the second dealing with the indebtedness of Cervantes to Heliodorus. For the first see *Modern Philology,* Vol. IV, No. 1 (1906).

[2] The frequency with which famous couples of legend and story were mentioned together may have led Cervantes from Theagenes and Chariklea to Aeneas and Dido. Moreover, the various editions of Mena's translation of Heliodorus have marginal references to both Homer and Virgil, there being more than a score to the Aeneid. The direct influence of the latter,

of Aeneas's adventurous wanderings; they could read an Aeneid done into Spanish in the true spirit of the Renaissance, and their ignorance of real antiquity would readily allow them to see in its characters and episodes many of the elements peculiar to a contemporary *roman d'aventure.* It contained long and striking voyages over unknown seas, shipwrecks and strange encounters, fierce and bloody combats, timely escapes, projects and schemes subject at every turn to ill fortune, but crowned at last by a successful issue; it had, above all, an episode of love and passion in the tragic story of Dido, which has awakened interest in all ages. So the excellence of Virgil's romance was bound to be recognized at a time when its peculiar sentiments must have been widely intelligible; when its martial passages would appeal to those fond of the romances of chivalry, and its pathos to those who favored the sentimental love-story.

Virgil had come down through the centuries with undiminished fame; in the schools of the Roman Empire he had been considered the foremost Latin classic, a rank which his perfection of diction and his charm of genuine and deep sentiment had assured him from the outset. During the dreary stretch of the Middle Ages, grammarians, scholastics and rhetoricians found in him a fruitful source for their numerous but dissimilar teachings; even at the very ebb-tide of learning, during the dark ages, he continued to be a large factor in whatever culture was left in the schools, all of which was no doubt due to the fact that his name and fame had been handed down as a tradition among all the peoples who had inherited Roman civiliza-

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notably of the fourth book, on the Greek romances would be difficult to trace and Rohde does not consider it in his great work, *Der griechische Roman* (Leipzig, 1900). But there can be no doubt that Aeneas and Dido were generally included in the list of loving couples, and as such may have become known through the scenic presentations of tragedy, or through wall or vase paintings; cf. Rohde, *op. cit.*, pp. 39-40, 42. It is, therefore, very likely that Heliodorus knew Virgil's version of the Dido legend. The following similar features in Virgil and Heliodorus deserve attention: the heroine falls in love with the hero at first sight; his physical beauty is very striking, cf. Rohde, *op. cit.*, pp. 158, 162, n. 1; the description of the hero, p. 164, n. 3; description of heroine's beauty, p. 165; he is like a god, pp. 165 ff.; love-sickness, p. 167 ff.; the love-sick heroine has no repose at night; the victims' passion is proclaimed in the dark of night or when wandering alone, and their thoughts are visualized in dreams.

tion.[1] And when Christianity began to spread through the Empire, it was natural that Virgil's prestige as a poet and sage should be readily accepted and transmitted by the teachers of the new religion, who had been educated in Latin schools. They even went farther. In their eagerness to turn an authority among the ancients into a luminary that would serve the Church, theologians interpreted the poet as a semi-Christian prophet, and pronounced his fourth eclogue an inspired prediction of the coming of Christ. Finally, with his prestige as a poet, sage and prophet so great among the learned, it was inevitable that a Virgil of a different type should grow independently among the masses who were not in touch with the little learning of the darker Middle Ages. This was the Virgil of folklore, a man of superhuman powers, an enchanter and magician, whose mythical history has been treated in a masterly fashion by Comparetti[2] and touches the subject in hand but little. The present article will therefore be devoted only to the Virgil of literature, whose influence as a romancer concerns us most.

It is worth considering at this point to what extent Virgil's reputation as a poet would have been curtailed, if his name had not issued from the Middle Ages linked inseparably with that of Dante. In

[1] Cf. D. Comparetti, *Virgil im Mittelalter* aus dem Italienischen übersetzt von Hans Dütschke (Leipzig, 1875), pp. 69, 91; M. Landau, *Die Quellen des Dekameron* (Stuttgart, 1884), 2te Auflage, p. 290: "Der fromme Aeneas hatte so viel Aehnlichkeit mit den Helden der Ritterromane, die Aeneis und die Eklogen haben im Verhältniss zur Ilias und Odyssee so viel Christliches in sich, dass Virgil und nicht Homer der Lieblingsdichter des Mittelalters werden musste." Cf. Bartsch, *Albrecht von Halberstadt und Ovid im Mittelalter* (Quedlinburg u. Leipzig, 1861), p. xxi; p. cxxii. Virgil was also prized more than Homer by the humanists in the 15th century; cf. W. Creizenach, *Geschichte des neueren Dramas*, Vol. II (Halle, 1901), p. 370.

[2] Cf. *op. cit.*, with the original title, *Virgilio nel Medio Evo* (Liverno, 1872). There is also an English translation, *Virgil in the Middle Ages*, translated by E. F. M. Benecke (London, 1895); other references to Virgil the magician are: Eneas Silvio Piccolomini, *Historia de dos amantes*, reprinted by R. Foulché-Delbosc (Barcelona, 1907), p. 13: *Virgilio subido por un cordel*, etc.; Juan Rodriguez del Padron also implies that the poet and the magician are the same person (cf. below, p. 482, n. 4); in the *Arcipreste de Talavera, (Corvacho ó reprobación del amor mundano)* by Alfonso Martinez de Toledo (1438), reprinted by the "Sociedad de Bibliófilos Españoles," Vol. XXXV, Virgil, the enchanter, is several times mentioned as a victim of earthly love, pp. 20, 49, 54; *Comedia de Calisto y Melibea* (1499), reprinted by R. Foulché-Delbosc in the "Bibliotheca hispanica,"

the latter fact can be found the bond which joins the Virgil of the Renaissance to the Latin poet of antiquity, and so preserves the continuity of his remarkable prestige. Dante's appreciation of his Latin master was to become thenceforward the standard opinion of him;[1] and, consequently, after the dreary ages of scholasticism and ephemeral church doctrine, Virgil and his poems survived as an abiding literary influence, destined to endure through any movement or change in religion and philosophy. By means of the fourth eclogue, and notably the sixth book of the Aeneid, which had not only contributed to expounding obscure theological doctrine, but had inspired the most comprehensive expression of mediævalism, the *Divina Commedia,* Virgil had survived the Middle Ages; by means of the fourth book of the Aeneid, through which he could claim the distinction of romancer as well as poet, he took root in the whole body of Renaissance literature, and left an indelible trace in the history of fiction. For the much admired delineation of Dido's passion has always made her tragedy appear modern from the standpoint of any age,[2] and its contents began to furnish romantic mate-

act 7, p. 88; Pedro Manuel de Urrea, *Penitencia de amor* (1514), p. 55 of reprint in the "Bibliotheca hispanica" edited by Foulché-Delbosc, 1902; Menéndez y Pelayo, "Antología de poetas líricos castellanos," *Tratado de los romances viejos,* Vol. XII (Madrid, 1906), p. 486: "mandó el Rey prender Virgilius, etc." where Virgil is merely a kind of mediæval knight in love; cf. also "Antología etc.," Vol. VIII, p. 226; Ruy Gonzalez de Clavijo, *Historia del gran Tamorlan* (Sevilla, 1582), p. 2; Lope de Vega, *Más pueden celos que amor,* Vol. II of "Comedias Escogidas" (Rivadeneyra), p. 186, col. 1; Dunlop-Liebrecht, *Geschichte der Prosadichtungen,* etc. (Berlin, 1851), p. 185 ff.; F. Liebrecht, *Zur Volkskunde* (Heilbronn, 1879), pp. 86, 88; Reinhold Köhler, *Kleinere Schriften,* etc. (Weimar, 1898-1900), Vol. I, pp. 140, 417, 585, Vol. II, p. 575; there is much unpublished material in the *Hertziana* of the royal library in Munich, in a box "Antike Sagen" No. 2, under "Virgilius," collected by the late poet and scholar Wilhelm Hertz; Menéndez y Pelayo, *Orígenes de la novela,* p. cxix ff. Boccaccio was also acquainted with the magic power of Virgil; cf. M. Landau, *G. Boccaccio, sein Leben und seine Werke* (Stuttgart, 1877), p. 235. In Timoneda's *Patrañuelo,* the fourth tale belongs to the history of Virgil, the magician; the *sors Homericae et Virgilianae,* Rabelais, "Pantagruel," book III, chapters 10, 12 are interesting in this connection.

[1] *Inferno* I, 79 ff.

[2] Cf. Sainte-Beuve, *Causeries du Lundi,* II, sixième édition, p. 123; R. Heinze, *Virgils Epische Technik* (Leipzig, 1903), chapter 3, on the art displayed in the drawing of Dido's character: "das Bewusstsein, dass sie

rial to writers of poetry and fiction as early as the fourteenth and fifteenth centuries. Thus a typically Renascent conception of Virgil came into existence, which made of him not the author of a pure classic of unintelligible past ages, but the writer of a deeply human *roman d'aventure,* whose ancient character, wherever copied or interpreted, was remoulded in the spirit of the new era.[1]

The assimilation of the story of Dido into literature was, however, assisted by various factors. The romance itself has always found favor with Christian and pagan alike; great Churchmen from St. Augustine to Luis de León or Bossuet[2] had been among Virgil's most fervent admirers. Again, the incorporation of all kinds of material from Virgil into letters of the Renaissance merely coincided with the absorption of the most important classic works; their influence on popular literature, especially in Spain and Italy, cannot be overestimated. This was due not only to the general spread of the legends,[3] the mythology and poetry of the ancients through the great centers of learning; it was furthered by the large number of translations which, printed in many cases with bulky annotations, served to popularize the foremost Latin and some of the Greek authors.[4] Finally, the more specific reason why Virgil's poetry

(i. e., Virgil's account) poetische Fiktion war, hat sich nicht verloren," p. 114.

[1] Cf. Landau's *Boccaccio, sein Leben, op. cit.,* p. 87, where he speaks of the attitude of the Middle Ages toward the classics.

[2] Cf. Sainte-Beuve, *Étude sur Virgile* (Paris, 1891), p. 101; *Causeries du Lundi,* X, troisième édition, p. 185, on *Bossuet.*

[3] Cf. Schack, *Geschichte der dramatischen Litteratur und Kunst in Spanien* (Frankfurt, 1854), Vol. II, p. 29, for an illuminating discussion of the absorption of classical literature by that of Spain.

[4] Some of the translations from the classics and the dates of editions (not always the first) are: 1. Homer, *La Ulyxea* (13 books) 1550, (24 books) 1556; on Spanish versions of the Iliad cf. *La Ilíada,* "Biblioteca clásica," Vol. III (Madrid, 1905); there is, however, an Iliad in Italian, 1564. 2. Thucydides, *Historia,* 1564. 3. Euripides, *Hecuba,* 1585?, *Medea,* 1599. 4. Sophocles, an imitation of the *Electra* in Pérez de Oliva's *La Venganza de Agamemnon,* 1531. 5. Plato, *Tutte l' Opere* (Italian) 1601. 6. Aristotle, *La Philosofia moral, etc.,* 1509; *Compendio de toda Philosofia Natural,* 1547; *Los ocho libros de republica,* 1584, etc., besides many in Italian. 7. Lucian, *Dialogos,* 1550. 8. *Heliodorus,* 1554. From the Latin: 1. Plautus, *Menechmos,* 1555; *Amphitrion,* undated edition in Gothic type in the Munich library, about 1530? Graesse, *Trésor, etc.,* gives an edition of 1574. 2. Terence, *Las seys Comedias,* 1577. 3. Virgil, *Encida,* treated elsewhere; *Georgicas,* 1586. 4. Horace, cf. Menéndez y Pelayo, *Horacio en España,*

became an important source of inspiration to Renaissance fiction, has been touched upon at the outset, and must be kept in mind. Owing to the great vogue of the romances of chivalry, whether in prose as in Spain or in verse as in Italy, a story of adventure, such as the Aeneid, quite naturally fell in with the current taste. On the other hand, the inclination of some readers toward a gentler kind of narrative, a kind of counterpart to the literature of combat and adventure, had given rise to the more idyllic pastoral novel, a type which is most deeply indebted to the Eclogues[1] and the Georgics. It was, therefore, by appealing to various tastes that Virgil easily acquired a new kind of supremacy. In his excellent work, *Orígines de la novela,* Menéndez y Pelayo asks apropos of epic poetry:

¿ Qué es la Odisea sino una gran novela de aventuras, en la mayor parte de su contenido? Pero los naufragios y trabajos del protagonista, los detalles domésticos más menudos, están envueltos en una atmósfera luminosa y divina que los ennoblece y realza, bañandolos de pura y serene idealidad. La categoría estética á que tal obra corresponde es sin duda superior á la de la ficción novelesca, que más ó menos se caracteriza siempre por el predominio de la fantasía individual, por el libre juego de la imaginación creadora (p. iv).

Precisely the same thing could have been said of the Aeneid; for its novelistic qualities would come home convincingly to six-

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2a edicion, Vol. I (Madrid, 1885). 5. Ovid, various translations of the *Metamorphoses,* 1580, 1589, etc.; *Heroides,* 1608; Italian version, *De Remedi contra l' amore,* 1576. 6. Aulus Persius Flaccus, *Satyras,* 1609. 7. Cicero, *De los Officios, de la Amicicia, de la Senectud, etc.,* 1549. 8. Pliny, *Historia natural,* books VII, VIII, 1599, IX, 1603, complete, 1624-29. 9. Seneca, the philosopher, *Los siete libros de Seneca, etc.,* 1601; *Las epistolas,* 1555; *Los Proverbios,* 1550; *Flores de Seneca,* 1550. 10. Lucan, *Historia, etc. (la Farsalia),* 1541. 11. Apuleius, *del Asno de Oro,* 1513. 12. Statius, *La Tebaide,* in Italian, 1570. 13. Musaeus, Boscan wrote a *Leandro* based on *Hero and Leander.* The examples could be greatly increased. Cf. also, Dieze, *Geschichte der Spanischen Dichtkunst,* p. 454 ff.; Graesse, *Trésor des livres rares, etc., op. cit.;* Salvá, *Catálogo de la biblioteca de Salvá;* Gallardo, *Ensayo etc., op. cit.;* the British Museum; the Biblioteca nacional, Madrid; the royal libraries of Vienna, Berlin, Munich, etc., contain most of the Renaissance classics.

[1] Dunlop-Liebrecht, *op. cit.,* p. 350; Menéndez y Pelayo, *Orígenes, etc.,* p. cdxix; H. Körting, *Geschichte des französischen Romans im XVII Jahrhundert,* 2te Ausgabe (Oppeln und Leipzig, 1891), Vol. I, p. 61, 120.

teenth century readers, and the story of Aeneas's hardships would be readily looked upon as a real *novela de aventuras,* in spite of any absence of *intimité,* that is, of those bourgeois qualities which chiefly distinguish a Renaissance story of adventure—such, for instance, as the *Persiles*—from the heroic epic of antiquity.

Let us see now how widespread acquaintance with the works of Virgil was, and consequently how common the imitation of some features of his epic or the borrowing of some of its sentiments. The testimony here adduced, though far from complete, ought to show that among Spanish poets, dramatists and novelists alike, from the middle of the fifteenth century through the age of Cervantes, the Aeneid was especially well known; allusions to it in some form or other can be found wherever the reader may turn.

During the fourth decade of the fifteenth century the Marqués de Santillana[1] wrote to his son, Don Pero González de Mendoza, then studying at the university of Salamanca:

Á ruego é instançia mia (about 1417), primero que de otro alguno, se han vulgariçado en este reyno algunos poemas, asy como la *Eneyda* de Virgilio . . . é muchas otras cosas, en que yo me he deleytado fasta este tiempo é me deleyto, é son asy como un singular reposo á las vexaçiones é trabajos que el mundo continuamente trahe, etc.

For the purposes of the present study, this testimony may be considered the earliest landmark of Virgil's influence on Spanish literature. In the Marqués de Santillana, however, the foremost poet of a courtly school of verse, Virgil is reflected but indirectly; the Aeneid, like other works of the ancients whom the Marqués had read only in translation, was to him largely a bookish love inspired perhaps at the outset by the eulogy of the *Divina Commedia.*[2] But the part of the Latin Epic which attracted the Spanish poet seems to have been the romance of Dido and Aeneas.[3]

Another work by a member of the Court of John II, the *Trezientas del famoso poeta Juan de Mena,* with glosses by Fernan

[1] Cf. Amador de los Rios, *Obras de Don Iñigo López de Mendoza, Marqués de Santillana,* etc. (Madrid 1852), pp. lxxxiii of *vida* and 482; Mario Schiff, *La Bibliothèque du Marquis de Santillane* (Paris, 1905), p. 89 ff.

[2] Cf. *Obras, op. cit.,* p. 5; p. 394, Dido in Hell as in Dante's *Inferno,* V, 61-2.

[3] Cf. *op. cit.,* pp. 195, 279, 333, 364, 371, 394, while 433 seems to refer to Ovid's *Heroides.*

Nuñez de Toledo, was frequently printed in the early sixteenth century.[1] Some of the stanzas have obscure references to the Aeneid, which are generally elucidated at length by Nuñez in glosses giving partial résumés of the story of Aeneas, as for example stanzas xxviii and xxxi, in which some of his voyages and the descent into the lower world are described; or lxxxviii with its allusion to the contest at archery of the fifth book of the Aeneid; or clxvi, which speaks of Aeneas's departure from Carthage and of some of his subsequent wanderings. In the *Coronacion* of the same poet Mena, also printed frequently with glosses, there are similar references, as in stanza xlviii, where the romance of Aeneas and Dido is told. In fact, in the fifteenth century, when Virgil was not yet known so widely as in the following age, the fourth book of the Aeneid left the most apparent trace. A volume of *Opúsculos literarios*[2] contains, among other productions of the fifteenth century, a poem by Juan Rodríguez del Padrón, also a poet of the reign of John II. Its title is *Decir contra el amor del mundo* (probably written about 1464), and one of its stanzas tells of Dido's tragic end.[3] But Rodríguez del Padrón was probably not a student of Virgil, or he was not acquainted with his epic outside of this story, for the poem, short as it is, has a reference to Virgil the Magician,[4] which may imply that he did not know the difference between the latter personage and the author of the romance of Dido.[5]

With the spread of humanism, however, a deeper appreciation followed, and the influence of classic literature on the Spanish poets of the sixteenth and early seventeenth centuries is everywhere apparent. Virgil is still in the lead, but with Ovid almost as prominent. Fray Luis de León's love for the former is well known: how he translated with characteristic charm the Eclogues and one

[1] I have before me an edition of Sevilla, 1517 (No. 3008 of Gallardo's *Ensayo de una Biblioteca española*), first edition Sevilla, 1499.

[2] Printed in Vol. XXIX of the "Sociedad de Bibliófilos Españoles"; on the poet, cf. Rennert, in the *Zeitschrift für Romanische Philologie*, Vol. XVII, "Lieder des Juan Rodriguez del Padrón"; and Menéndez y Pelayo, *Orígenes, op. cit.*, p. cccv on *el Siervo libre de amor*.

[3] Cf. *Opúsculos*, etc., *op. cit.*, p. 369.

[4] Cf. *op. cit.*, p. 368.

[5] This confusion is manifest in many writers and may be an explanation of that peculiar popular attitude toward the Aeneid, which held it to be a magic book capable of deciding one's fate. On the "sors Virgilianes" cf. p. 477, n. 2, above.

of the Georgics,[1] and how, when imprisoned by the Inquisition, he called for his favorite poets, among them Virgil, of whom he possessed numerous copies.[2] D. Diego Hurtado de Mendoza has left an *Elegía á la muerte de Dido*,[3] which is a free rendering of the close of the fourth book of the Aeneid. The latter's influence is also apparent in Herrera, *Elegía* xv, 'To love.'[4] Even Góngora makes use of Dido in a characteristic way while speaking of the bee.[5] Juan de Arguijo has two sonnets, one *Á Dido y Eneas*, and one *Á Dido*.[6] Quevedo also indulged in a humorous parody of Dido's lament when forsaken by Aeneas, *siquis mihi parvulus aula luderet Aeneas* (IV, v. 328).[7]

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[1] Ticknor says "two of the Georgics of Virgil," *History of Spanish Literature* (London, 1863), Vol. II, p. 86; cf. Vol. II of "Escritores del siglo XVI" (Rivadeneyra), *Obras del maestro Fray de León*, which contain but one, and p. xiv of the introduction.

[2] Cf. Ticknor, *op. cit.*, Vol. II, p. 87 n.

[3] Cf. *Obras poéticas de D. Diego Hurtado de Mendoza*, printed for the first time in Vol. XI of "Libros españoles raros ó curiosos" (Madrid, 1877), p. 95. There is also, if authentic, an *epigrama á Dido*, p. 432.

[4] Cf. *Poetas líricos de los siglos XVI y XVII* (Rivadeneyra), *Elegia* xv, p. 288: where

> Si no eres en las rocas engendrado
> Del alto yerto Cáucaso espantoso,
> Y de la Armenia tigre alimentado,
> Serás á mis tormentos piadoso, etc. (p. 289)

recalls vs. 366-7 of Aeneid IV; the *Armenia* for *Hircania* as applied to tigers has its source in the Eclogues, V, v. 29.

[5] Cf. *Poetas líricos, etc., op. cit.*, p. 472, col. 2; what could be more characteristic of Góngora than:

> ". . . frondoso alcázar, no de aquella
> Que sin corona vuela y sin espada,
> Susurrante amazona, Dido alada,
> De ejército más casto, de más bella
> República, ceñida en vez de muros,
> De cortezas; en esta pues Cartago
> Reina la abeja, oro brillando vago, etc."

[6] Cf. *Poetas líricos, etc., op. cit.*, p. 392: "De la fenisa reina importunado"; p. 398: "La tirana codicia del hermano"; see also his sonnet prefixed to Lope de Vega's *Peregrino en su patria* (1604), in which Lope's wanderer is compared with both Ulysses and Aeneas, and Lope himself with Homer and Virgil.

[7] Cf. *Obras de Quevedo* (Rivadeneyra), Vol. III, p. 137: "Si un Eneillas viera, si un pimpollo, etc."

Nor have the later poets forgotten the possibilities of the old theme.[1]

How early the matter of Virgil's epic got into ballads, the most popular form of Spanish verse, is hard to determine, but the romance of Aeneas and Dido was made the subject of a ballad, if Durán's conjecture is correct, in the beginning of the sixteenth century.[2] The time of composition is, however, of little importance, because, as Menéndez y Pelayo has already remarked,[3] the poem was probably written by some one acquainted with the original, and is, therefore, only a semi-popular production in ballad form. The treatment shows nothing of the mediæval manner which turned ancient heroes into contemporary knights with no traces of ancient civilization about them.[4] In his *Romancero general* Durán prints several other ballads[5] upon the same subject, but all were mani-

[1] D. Juan Maria Maury wrote a poem of considerable length (Canto épico) on Dido's story: cf. *Poetas líricos del siglo XVIII* (Rivadeneyra), p. 175 ff.

[2] It begins: "Por los bosques de Cartago | saltan á montería | La reina Dido y Eneas | con muy gran Caballería"; cf. *Romancero general ó Coleccion de romances Castellanos anteriores al siglo XVIII*, recogidos, etc., por D. Agustín Durán (Madrid, 1859), Vol. I, p. 325; "Antología, etc." *op. cit.*, Vols. VIII and IX, "Romances viejos castellanos, etc." 2a edicion corregida y adicionada por D. Marcelino Menéndez y Pelayo (Madrid, 1899), Vol. VIII, p. 223, Vol. IX, p. 308; see also Appendix I, below. One ballad is aptly cited by Clemencin: "La desesperada Dido, | De pechos sobre una almena, | Dice viendo por el mar | Huir la flota de Eneas, etc."; cf. his edition of *Don Quixote* (Madrid, 1894), Vol. VIII, p. 234 ff.; it is no. 489 in Durán's *Romancero*.

[3] "Antología, etc." *op. cit.*, Vol. XII, p. 484.

[4] On the other hand, such a version of the Dido story as is given in the old French *Roman d'Enéas*, while reasonably close to the original, has nevertheless the stamp of the age which produced it; cf. *Eneas*, texte critique publié par Jacques Salverda de Grave (Halle, 1891), p. xxx ff. It omits the games because, perhaps, they could not be adapted to the mediæval spirit; cf. also Comparetti, *op. cit.*, p. 212 ff., German version.

[5] Cf. *op. cit.*, p. 323, numbers 483-91; in this connection the famous English ballad, *Queen Dido*, is of interest; cf. *Reliques of ancient English Poetry, etc.*, by Bishop Percy (Philadelphia, 1890), Vol. III, p. 191. As a general rule, however, legends which are inherited from a dim past undergo fantastic transformations in folk-lore and ballad literature; Aeneas and Dido were no exceptions; cf. Du Méril, *Études sur quelques points d'archéologie, etc.* (Paris, 1862), p. 429; "En Italie . . . le valeureux Enée n'est plus qu'une pauvre reine qui soupire pour l'ingrat Didon."

festly written when the Aeneid had become more widely known, possibly after a Spanish version had been published, and so belong to the last third of the sixteenth century. While these ballads are more or less true to the subject-matter of the Aeneid, they show also by their manner that the story appealed to writers much after the fashion of contemporary romances of adventure; they are a further evidence of the general popularity of the Latin epic.

The dramatic situations in the story of Aeneas and Dido were recognized early by writers for the stage, but owing to the difficulty of constructing a well-made play out of any one, or several of them, none is of the highest order. Mere imitations, however, of the pathos of Dido's situation as well as simple references to her sad fate begin early in the history of the Spanish drama, and grow very numerous toward the end of the sixteenth and the beginning of the seventeenth centuries. Dido, according to the two views of her character, treated at the end of this article,[1] was either a chaste matron, true to her dead husband, and as such was held up as an example, or she was a yielding female, betrayed and forsaken, and so a warning to misguided women who might love, not wisely, but too well. All these allusions have the qualities of romance, but their rather stereotyped character implies that the story of Dido was known to all, whether they had an academical education or not. There are also other episodes of the Aeneid which receive frequent mention, notably when an author desires to compare them with similar incidents of his own work. Troy in flames, kindled by the fire of love, the chastity of Camilla, the friendship of Euryalus and Nisus, the loyalty of Achates, the filial piety of Aeneas, these are among the more common reminiscences.[2] But all are overshadowed by the episode of the fourth book of the Aeneid, a fact to be explained, perhaps, by the influence of that romance on prose fiction.[3]

In the theater, it begins as early as Juan del Encina's *Egloga de Plácida y Victoriano.* After being forsaken by Victoriano,

[1] Cf. Appendix I, p. 517.

[2] The fact that Dante treats some of the Virgilian episodes as real events and introduces some of the characters of the Aeneid into the Divine Comedy may be considered a significant beginning of their frequent mention in subsequent literature; cf. *Inferno,* I, 73-4; I, 107-8; IV, 122, 124; V, 64; XXVI, 90-3.

[3] The theme of sentimental death or suicide in the Aeneid was supported by the tone of some of the Eclogues; cf. II, 7; V, 20; VIII, 17 ff.; 59, etc.

Plácida utters two long laments, both of which recall the words of Dido,[1] and as the Queen of Carthage kills herself with the sword of Aeneas, so Plácida commits suicide with the dagger left behind by Victoriano. But Encina's indebtedness to Virgil is best shown by his paraphrases of the Eclogues, and his admiration of the poet in the dedication prefixed to them.[2] After his day references to

[1] Cf. *Teatro Completo de Juan del Encina*, edición de la Real Academia Española (Madrid, 1893). The first is in part:

1. Lastimado corazon,
Mancilla tengo de tí.
¡ O gran mal, cruel presion !
No tenía compasion
Vitoriano de mí
Si se va.
Triste, ¿ de mí qué será ?
¡ Ay, que por mi mal le ví !
p. 262.

2. Conhórtase con morir
La que pena como yo ;
Mas sólo por le servir
Querria, triste, vivir.
¡ O traidor ! ¿ Si se partió ?
¡ No lo creo !
Mas sí creo, que mi deseo
Tarde ó nunca se cumplió.
p. 263.

3. Di, mi dulce enamorado,
¿ No me escuchas ni me sientes ?
¿ Dónde estás, desamorado ?
¿ No te duele mi cuidado
Ni me traes á tus mientes ?
¿ Dó la fe ?
Di, Vitoriano, ¿ por qué
Me dejas y te arrepientes ?
p. 265.

4. Por las ásperas montañas
Y los bosques más sombríos
Mostrar quiero mis entrañas
Á las fieras alimañas
Y á las fuentes y á los ríos ;
Que aunque crudos,
Aunque sin razón y mudos,
Sentirán los males míos.
p. 266.

The second, beginning "soledad penosa, triste," has these noteworthy stanzas:

Á sabiendas olvidaste
¡ O traidor ! este puñal.
Cierto muy bien lo miraste,
Y aparejo me dejaste
Para dar fin á mi mal.
¡ O cruel !
Recibe la paga dél
Y este despojo final.

No fué más cruel Neron
Que tú eres, y esto creas :
Yo Filis, tú Demofon ;
Yo Medea, tú Jason ;
Yo Dido, tú otro Eneas.
En él, tigre,
Aunque causas que peligre,
Nunca en tanto mal te veas.
p. 315.

Cf. also p. 210, for a mention of Dido among noted women.

[2] Cf. Ticknor, *op. cit.*, Vol. I, p. 247; W. Creizenach, *Geschichte des neueren Dramas*, Vol. I (Halle, 1893), p. 348; Gallardo, *Ensayo, etc.*, Vol. II, col. 812: "Acordé dedicaros las Bucólicas de Virgilio que es la primera de sus obras . . . E despues siguióse la agricultura. E andando mas el tiempo siguieron batallas. Y en esta manera el estilo del grand Homero mantuano procedió. De las cuales por agora (intentaria quizá traducir tambien la Eneida ó las Georgicas?)"

the Aeneid occur frequently in the sixteenth century drama,[1] while the desire to imitate the classics in form as well as in the use of standard episodes prompted the choice of Dido's story for the stage.[2] On account of the meagerness of the material for an entire

[1] Some examples are: Torres Naharro, *Comedia Jacinta:* "Segunda Dido Africana" (near beginning); Jerónimo Bermúdez, *Nise Lastimosa*: "la sabiduría | de Salomón, ¿ contra el amor que vale? | O Troya, Troya, ¿ quién te puso fuego, | y no dejó de tí ni aún las cenizas?" (Act I); L. Leonardo de Argensola, *Isabela*, Prólogo: "No soy aquella Fama que Virgilio | dijo, y malgrado del gran Marón, tú, Dido, | entre las viudas castas te colocas"; cf. also II, sc. 4, a reference to wooden horse of Troy; Dr. Fr. Tárrega, *La enemiga favorable;* loa en alabanza de las mugeres feas (near beginning): "[la fea] no es la Cava para España | ni para Troya otra Elena | ni Dido para Cartago"; Gaspar de Aguilar, *El mercader amante*, (Act II): "Caballo de Troya hiciste | De un pensamiento seguro, | Y para que entrase, el muro | De tu vergüenza rompiste, etc."; Alfonso Velazquez de Velasco, *El Zeloso*, Act I, sc. 2: "¿ Quién puso á Troya en tanta ruina y desventura, que de ella no dejó casí cenizas?" In Rojas, *El Viaje entretenido*, two volumes (Madrid, 1793), first edition, 1604, there are also numerous references to Virgil and his Aeneid, similar to those so common in the literary vocabulary of the times; Virgil is used for comparison after the current fashion: "muestras ser en este tu viage, | Virgilio en verso, etc.," Vol. I, p. 31, also pp. 20, 28, 32; II, p. 145, while in the *exposicio de los nombres*, etc., p. 263, he says: "Virgilio, Principe de los Poetas, que en los seis de la Eneida, cuenta las peregrinaciones de Eneas," as though the poem were a kind of adventure story in six books; reminiscences of the Aeneid may perhaps be seen in the storm I, p. 66, also in pp. 78, 97; "la honestidad . . . de la reyna Dido," 201; 207.

[2] In Spanish the following plays are based on the story of Dido, with or without Aeneas: Gabriel Lobo Laso de la Vega, *La honra de Dido restaurada*, cf. Barrera, *Catálogo del teatro antiguo español*, p. 219; Cristóbal de Virués, *Tragedia de Elisa Dido*, cf. Barrera, *op. cit.*, p. 499; both are mentioned in Moratín, *Orígenes del teatro español* (Rivadeneyra), pp. 217, 225; cf. also Wolf, *Studien zur Geschichte der Spanischen und Portugiesischen Nationallitteratur* (Berlin, 1859), p. 616-7; Guillen de Castro, *Los amores de Dido y Eneas*, cf. Barrera, *op. cit.*, p. 83; Cristobal de Morales is credited with a play, *Los amores de Dido y Eneas* which I have not seen, cf. Barrera, *op. cit.*, p. 274; Alvaro Cubillo de Aragon, *La honestidad defendida, ó Elisa Dido, Reina de Cartago*, cf. Barrera, *op. cit.*, p. 115. Of more recent times there is the *Eneas y Dido*, Comedia famosa, etc., de un ingenio Cathalan (Barcelona, 1733); and the *Dido* by Juan C. Varela, cf. a recent rendering of Virgil, *Eneida*, etc., traduccion de Caro (Madrid, 1905), p. xii. There have been *Dido* tragedies in Latin from 1550 on, cf. Creizenach, *op. cit.*, Vol. II, pp. 164, 378, n. 1; in Italy the subject of Dido

play, the results, however, are of a purely historical interest to a student of the Spanish stage, and, with the possible exception of Virues's *Elisa Dido,*[1] an attempt to imitate the ancient style, and Castro's *Los Amores de Dido y Eneas,*[2] an excellent specimen of that poet's power of dramatic expression, they are now dull reading.

As is natural, the prolific Lope de Vega is our most important criterion in this matter. His plays are throughout a mine of information for those who are searching for classical reminiscences in that popular form of literature, the drama. Since Lope must have introduced all his learning in the heat of composition and frequently without deliberation, the copious classical material which he controlled is certainly astounding. However much we may believe

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has been treated frequently, there being a play by Alessandro de' Pazzi (1524), *Didone*, one by Giovanni Geraldi (Cinthio), (1543), of the same title, and one by Lodovico Dolce (1547); cf. Klein, *Geschichte des Dramas*, Vol. V, pp. 350 ff., 399 ff. (Leipzig, 1867); and Creizenach, *op. cit.*, Vol. II, pp. 391 ff., 397, 412; there is also a *Didone abbandonata* by Metastasio; in France, Jodelle wrote *Didon se sacrifiant*, Creizenach, *op. cit.*, Vol. II, p. 446, and Petit de Julleville, *Histoire de la Langue et de la Littérature françaises*, Vol. III, seizième siècle (Paris, 1897), p. 269.

[1] Cf. Ticknor, *op. cit.*, Vol. II, pp. 65-6 and note.

[2] When Lope de Vega dedicated *Las Almenas de Toro* to D. Guillen de Castro he took the occasion to praise the excellent tragic style of the latter's *Dido:* "Entre las tragedias que vuestra merced tan ingeniosamente ha escrito, para lo que tiene genio particular (como estilo superior y digno de mayores sentencias y pensamientos), es la *Dido* celebradísima, á quien el día que yo la oí en esa ilustrisima ciudad hice este epigrama:

Fenisa Dido, que en el mar Sidonio
Las rocas excediste conquistada,
Y en limpia castidad, jamás violada,
Conservaste la fe del matrimonio:
Perdona el atrevido testimonio,
No por ser de Virgilio celebrada,
Mas porque ya de don Guillén honrada,
Rompe su enojo, y su epigrama Ausonio.
La diosa que en la mar nació de espuma
Adore por sus versos tu belleza,
Pues te levantan á grandeza suma;
Rinde á su dulce ingenio tu aspereza:
Que más gana tu fama con su pluma,
Que pierde en ser burlada tu firmeza."

Cf. *Obras de Lope de Vega* publicadas por la Real Academia española, Tomo VIII, p. 79; and Schack, *op. cit.*, Vol. II, p. 445.

that allusions to the works of ancient writers, to mythology or history, had in his day become a part of current culture and so lay in the atmosphere; however frequently one writer took from another the manner of parading bookish learning and pedantry, in the case of Lope we are bound to conclude that his genuine fund of information in classical matters was inexhaustible. Nothing pertaining to ancient literature or history escapes mention. But, we are impelled to ask, what percentage of his audience understood this array of learned allusions? It is certain that to-day practically no one would catch the force of a reference to something in Plutarch or in Livy. There can be no doubt, therefore, that owing to the popularization of the best of the ancients, chiefly through translations, a large part of the theater-goers appreciated most of the stage use of classical material. In all this Virgil and his Aeneid play a significant part, and we may infer as a consequence that the epic had not only become widely popularized, but that the mention of certain episodes in it descended to the commonplace. Chief among them[1] are the burning of Troy, Aeneas's escape with his father upon his shoulders, his wanderings, the episode in which Dido figures, the descent into Hades, the friendship of Euryalus and Nisus, and the story of Camilla, the chaste maiden. Most of these had no doubt become traditional through various channels, so that to refer to them was like alluding to a well-known current romance. After Lope, the manner of introducing classical allusions became less frequent, for, with the exception of Calderón, the writers who followed his methods did not have at their beck and call an equally comprehensive acquaintance with the ancients.

The influence of the Aeneid on prose fiction of the Renaissance will now be of peculiar interest in connection with the study of Cervantes. Here was a medium which could most readily absorb its material; the various types of prose story attempted during this epoch could find in Virgil some source of inspiration; whether the themes were martial or sentimental, some portions of his work would prove suggestive. Moreover, the Aeneid was strengthened in matters of sentiment by the Eclogues; in the lamentations of love, thoughts of suicide, grief over separation, the fourth book was not unlike the eighth Eclogue, and their influence was no doubt fused early in the Renaissance.[2]

[1] Cf. Appendix II, p. 520.

[2] Cf. Creizenach, *op. cit.*, Vol. II, p. 367; above, p. 485, n. 3.

In Menéndez y Pelayo's discussion of the *novela sentimental,*[1] the first story of importance discussed at some length is Boccaccio's *Fiammetta.* Since no better starting-point could be taken for the present study, the words of the Spanish critic are of interest:

Los defectos que la Fiammetta tiene para el gusto de ahora . . . no lo eran para los contemporáneos y parecían otros tantos primores. Nuestros prosistas del siglo XV la tuvieron en gran estima, procuron imitarla, y . . . se ven las huellas de este modelo de tan dudosa belleza.

Accepting, then, the influence of this work at the earliest stages in the history of the novel, it is noteworthy that the little romance is dominated throughout by the story of Dido.[2] The heroine's passion, her lamentation when forsaken, her remorse, these among others are but so many parallels to situations or sentiments of the fourth book of the Aeneid.

Another of the early love stories, and the next in importance in the growth of the novel in Spain, is Eneas Silvio Piccolomini's curious *Historia de dos amantes,* translated from the original Latin into Spanish late in the fifteenth century.[3] No one can fail to see in it the influence of Virgil's romance.[4] The plot is singularly bare and

[1] *Orígenes, op. cit.,* p. ccc.

[2] A summary of the chapters of the *Fiameta* [cf. *Libro llamado Fiameta, etc.* (Lixboa, 1541), in the Bibliotèque Nationale, Paris] will suffice: 1. Beginnings of Fiameta's love. 2. Panfilo's departure and her grief. 3. Her thoughts during his absence. 4. Preparations for his promised return. 5. Rumors of his marriage and her despair. 6. She hears that he is not married but in love with another *dueña;* she desires to kill herself. 7. False rumor of his return, and her consequent disappointment. 8. Comparison of her situation with that of other forsaken women: "Vieneme delante con mucha mas fuerça que ningun otro, el dolor de la desemparada Dido, porque mas al mio semejante le conozco quasi que otro alguno." 9. Moral, and parting reflections. For the mention of Dido's story in Boccaccio's *Laberinto de amor, op. cit.,* cf. Appendix I, p. 518.

[3] Cf. Menéndez y Pelayo, *Orígenes, etc., op. cit.,* pp. cccliii and cccxx; the Spanish version has been reprinted by Foulché-Delbosc (Barcelona, 1907); the editor (dedication) calls the story "la más hondamente humana de cuantas nos han dejado los albores del Renacimiento."

[4] Dido's illness through love was of influence on the following passage; Eurialo (whose name is probably taken from Virgil) is absent, p. 26: "en tanto queda Lucrecia bien sin abrigo: cierra las ventanas, vistese de tristeza, nunca fue vista salir de casa. Todos se marauillan, no saben la

simple; the love of Lucrecia for Eurialus, her gradual yielding, his departure and her death, these are the chief features, and the genuine tone in which the tale is told amply accounts for the popularity which it had long after its day.

A work which also originated in Italy, but which deserves a place[1] in Spanish fiction, is the *Libro de los honestos amores de Peregrino y*

causa. Quasi viuda en todos sus autos se mostraua; y como si el sol eclipsara, parecia a los de casa estar en tinieblas; siempre como enferma esta en la cama, nunca la veen alegre: buscanle remedios para el cuerpo, y la enfermedad mora en el anima, etc." Lucrecia writes to Eurialo, p. 20: "Tu aqui no puedes mucho tiempo estar, ni yo despues de entrada en el juego podria sin ti biuir. Tu no me querras lleuar, ni yo quedar tu partiendo. Temor grande me ponen los enxemplos de muchas que de amantes estrangeros fueron desamparadas, para que no siga tu amor. Jason engaño a Medea, . . . Que dire de Dido malaventurada, que al fuydo Eneas rescibio? por auentura no la mato amor estrangero? Se quanto es incierto y dudoso para no me auenturar a tantos peligros." Eurialo is obliged by his duty to his Emperor to depart, p. 53: "sintiolo Lucrecia. Que no siente el amor? o quien podra al amante engañar?" She writes to him: "si mi animo se pudiesse contra ti ayrar, ya con razon me ensañaria, porque tu partida dissimulas . . . Ay, mi coraçon, que es la razon que la partida del Cesar me encubres? El se apareja al camino; tu no quedaras, bien lo se. Que se hara de mi, que sin ti biuir no podre? Que hare malauenturada? donde holgare? Que deseanso me quedara? Si me dexas, no creas dos dias biuire. Por estas letras de mis lagrimas mojadas, por tu mano derecha y fe dadas, si algun merecimiento tengo o algo de mi te fue agradable, te suplico desta malauenturada amante ayas compassion. No que quedes te demando, mas que me lleues contigo, etc." And then the author cites other cases of death through love, p. 57: "Dido phenisa, despues la fadal partida de Eneas, a si mesma mato . . . Esta nuestra, como vido a Eurialo partir de su vista, cayda en tierra, la lleuaron a la cama sus sieruas, etc."

[1] Menéndez y Pelayo, *Orígines, etc., op. cit.*, p. ccexl, eliminates this story, but it seems to me that a history of Spanish fiction ought to include a work which was of influence in its day in Spain as well as Italy. Six or more editions in Spanish speak for themselves. I am obliged to quote from the Italian version. The following are among the allusions to the Aeneid; cf. *Libro del Peregrino* nuovamente ristampato, e con somma diligenza corretto et alla sua pristina integrità ridotto (Vinegia, 1538): "O sola conscia del mio secreto affanno, littera mia, Dio ti presti quella felicità, che 'l fece al profugo Troiano, quando nel gremio di Elisa fece sedere il fratel cupido, etc.," p. 8; "Et se la Regina Carthaginese de udienza fusse stata parca haueria con laude eterna dall' amato Sicheo l' ombra seguita," p. 15; there are also direct imitations of the Aeneid, as in a description of dawn, p. 39,; or allusions in "Come per attestare il Mantuano" and the

Ginebra. As a romance it is important not only because it is a mixture of the sentimental type with that of adventure, but because many a page is more or less reminiscent of the Aeneid. In fact, the general testimony justifies the conclusion that the author, Caviceo, looked upon the epics of Homer and Virgil as types of adventure stories with whose episodes and sentiments those of his own production could well bear comparison.

The little work of Juan de Segura entitled: *Epistolario o processo de cartas de amores,* followed by *Una quexa y aviso contra amor,* is also full of classic references, some of which are sufficiently reminiscent of Virgil[1] to strengthen the conviction that hardly a love and

like; Aeneas and Dido, p. 44_2; Achates, p. 54_2; Dido's eager attention to the narrative of Aeneas, p. 81_2; Genevera's lamentation, pp. 108 and 141_2: Peregrino is consoled in his hardships by his *fido Achate:* "le fatiche, et li errori hanno commendato Vlisse: li pericoli, et naufragii celebrato Enea, etc.," as though all of these works belonged to Peregrino's class of *novela,* namely *de aventuras,* p. 111_2; Dido's death, p. 112_2; Camilla and Turnus, p. 138; a descent into the lower world modeled on the classics, p. 150; p. 176 ff. with a partial influence of Dante's *inferno;* Dido and Aeneas, p. 247, etc.

[1] Cf. *Epistolario, o processo de Cartas de Amores: con vna carta para vn amigo suyo: y una quexa y auiso contra amor.* Traduzido del estilo Griego en nuestro politico Castellano: por Joan de Segura. Asse añadido en esta impression vna egloga: en que por subtil estilo el poeta Castellano Luis Hurtado tracta del gualardon y premio de amor. [Alcalá de Henares] MDLIII; the grief of the heroine recalls that of Dido, in the following: "A mi cargo toda la culpa como por quien todo el mal se ha causado: que si yo no os vuiera tan a vanderas desplegadas dado mi libertad: mostrando os la voluntad que os tenia; no vuierades menospreciado assi mis desuenturadas cartas . . . Mal haya la muger que por hombre alguno su vida y honrra auentura como yo por vos he hecho: . . . que vistes en mi para assi oluidarme? Quando fue hombre tan bien querido . . .? O falso, cruel matador: dime si pensauas viendome aqui metida oluidarme: porque me ordiste tan gran lazo: donde toda mi vida a tu causa encubierta y con dolor estare . . . Pluguiesse a Dios aun que fuesse luego mi muerte: que vn momento solo contigo me viesse, etc.," p. 31_2; "qual Dido . . . a mis males & infortunios ygualara? . . . Ay de mi sin remedio alguno pues otro no tengo saluo morir." And in the *quexa y auiso contra amor,* cf. a complaint to Love: "Pues dime, que pago diste [a] aquella tan nombrada & miserrima Dido?" p. 49; an obscure reference to the Aeneid VI: "introduciendo Palinuro a Acaron, etc.," p. 60_2; "parose tan triste que no se le comparo aquel famoso rey Priamo quando a su gran Troya arder veya etc.," p. 82_2.

adventure story could well be written at this epoch without some indebtedness to situations or sentiments in the Aeneid.[1]

A work in prose fiction of peculiar interest in the study of Cervantes is, as has been indicated in previous articles, Núñez de Reinoso's *Clareo y Florisea.* Menéndez y Pelayo speaks of one episode, the descent into the inferno, ch. xxxi, as "llena de reminiscencias del libro sexto de la Eneida"[2] to which can be added Isea's dream, ch. xxi, since she herself compares it with that of Aeneas, who in his dream converses with Hector's ghost (II, v. 268 ff.).[3] Thus it is evident, that after exhausting his chief source, the *amorosi ragionamenti* of Dolce, Núñez de Reinoso had recourse to the

[1] In another early *novela,* Diego de San Pedro's *Carcel de Amor* (Sevilla, 1492), there is a chapter which proves "por enxemplos la bondad de las mugeres (p. 78, of "Bibliotheca hispánica," Vol. XV, Madrid, 1904). Virgil's Camilla gets an honorable mention, p. 82, while Dido, known perhaps to Diego de San Pedro only as the heroine of the Aeneid, and not as the chaste matron so frequently defended against calumny, is left out; cf. also the later version of the *Celestina,* act xvi: "Venus, Madre de Eneas." Other works of fiction of the type of the Celestina refer familiarly to the Aeneid. Thus in the *Thebayda* (1521), cf. "Coleccion de Libros españoles raros, etc.," Vol. XXII (Madrid, 1894), p. 274, Berintho says to Menedemo: "Veote estar, Menedemo, vacilando y envolviendo en tu anima tantas cosas, como el piadoso Eneas, etc."; in the *Comedia Seraphina* (1521), Coleccion de Libros españoles, etc.," Vol. V (Madrid, 1873), p. 373 ff.; "en verdad tan atordido estoy de lo que me dices, como el piadoso Enéas oyendo la respuesta de Apolo quando tentó de abaxar á la ribera donde halló vagando al buen Palinuro, etc;" reference to "el gran Mantuano," p. 396; in the *Comedia Selvagia* (1554), cf. same volume, p. 8, the author says of Love: "Tambien Marón, entre los latinos poetas fénix único, todo el quarto libro de su Eneida en decir sus inicuos hechos ocupó;" and p. 136 there is a reference to the sixth book of the Aeneid: " ¿ quién es esta fantasma? Por ventura el fuerte Eneas, . . . con la anciana Sibilla, quieren en los infiernos . . . entrar la segunda vez? etc."

[2] *Orígenes, etc., op. cit.,* p. cccxlvi; cf. also, Rohde, *op. cit.,* on descents into Hades as episodes in mediæval literature, p. 279; *Hertziana* (Munich library), *op. cit.,* box 22, "Sagen," under "Unterirdische Wanderungen"; Quevedo, *Obras, op. cit.,* Vol. I, p. 307: "las Zahurdas de Pluton, (Sueño del Infierno)" reads in part like a travesty on the sixth book of the Aeneid and of Dante's Inferno; "doy fe de que en todo el infierno no hay arbol ninguno, etc." In the *Galatea, Obras, op. cit.,* there is mention made of Aeneas and his descent into the inferno, p. 57, col. 1.

[3] Cf. also the dream of Chapter xxix, p. 464, "Novelistas anteriores á Cervantes" (Rivadeneyra).

classics, making use of Homer,[1] perhaps, and of the Dido episode. For the mere creating of situations into which expressions of the regret and grief of a forsaken woman were introduced justified any slight borrowing from the sentiments of Virgil. The phraseology of the fourth book of the Aeneid, at least, is unmistakable in chapter xxviii. Other more trifling similarities could be pointed out.[2]

With regard to the descent of Aeneas into the lower world, Dante had already created the prototype for imitations, and in the Renaissance the journey was copied as an episode of adventure by poets and novelists alike.[3] I have already noted its influence upon the story of *Peregrino y Ginebra*;[4] there is probably a similar indebtedness to be found in Jerónimo de Contrera's *Selva de Aventuras,* the hero of which arrives at Naples and enters the cave of the Cumaean Sibyl.[5] After passing through a dark passage into

[1] Cf. p. 438, col. 2: where Isea undoes at night the work of the day.

[2] Cf. p. 438, col. 2: "sintiendo yo abrirse la puerta, temblaba pensando que seria algun recaudo de Clareo; y como me hallase engañada tornaba á mi pena llorando . . ., y algunas veces me subia á unas altas ventanas, de las cuales se veia la mar, y comenzaba de mirar aquellas bravas ondas, y quejábame porque me habian dejado con la vida, etc."; p. 457, col. 2, Estrellinda's lament; p. 461, col. 2: "Oh duro y sin fe ninguna, Felesindos! Y es posible que te baste el ánimo á partirte de mí, que tanto te quiero, y á peregrinar por ajenas tierras, podiendo hallar comigo ciudades y castillos, reposo y descanso? Y ¿ es posible . . . que estas lágrimas mias no te detengan y la fe y palabra que me diste? . . . Pues pidote, por el amor que te tengo, y por cualquier servicio que de mi hayas recebido, y por la palabra que me diste, que tengas piedad di mi y que no te partas . . . A las cuales razones Felesindos respondió: las grandes mercedes y beneficios que de vos, señora Estrellinda, yo he recebido, jamás negaré . . . Y pluguiera á Dios que yo pudiera quedar en esta tierra y serviros; pero por los dioses inmortales, que yo no puedo, porque los hados ordenaron traerme asi desasosegado hasta llevarme, despues de muchos trabajos, adonde tenga descanso . . ." And Estrellinda replies angrily: "Yo creo verdaderamente, que hombre tan sin piedad no puede ser nacido sino de algunos tigres de Hircania, ó criado entre algunos duros saxos, etc."; the grief of Dido is also reflected in *El Caballero Cifar,* cf. Menéndez y Pelayo, *Orígenes, etc., op. cit.,* p. excvii.

[3] Cf. Ariosto's imitation of the prophecy of Anchises in *Orlando furioso,* Canto III.

[4] Cf. p. 491, n. 1.

[5] Cf. sixth book; "Novelistas anteriores á Cervantes" (Rivadeneyra), p. 497 ff.

a beautiful meadow he meets the Sibyl in her palace (at the same time a cave), where she prophesies to him regarding his own future and that of Spain. All this is a kind of variation of Virgil and very characteristic of the romances which mingled the old type of chivalry with the newer story of adventure.

The influence of Virgil's epic upon Spanish fiction, exerted indirectly as well as directly, was also reinforced by Italian romances in verse and prose; they, in their turn, show to what extent his extraordinary prestige had maintained itself from Dante through Petrarch and Boccaccio, and how prominent it is among the influences which are dominant in the literature of the Italian Renaissance. This is not the time to dwell on the indebtedness of Boiardo, Ariosto, or Tasso[1] to Homer and Virgil, but the fact that the works of both were imitated in their writings may have prompted others to borrow more extensively from the classics. This seems to be especially true in regard to Sannazaro's *Arcadia.*[2] As there are few works in Italian literature which show a freer imitation of Virgil, so there is scarcely another which forms a more important link between Italian and Spanish literature. The Spanish pastoral novel, at least, cannot be understood without it. While Sannazaro imitated the classics directly,[3] later authors copied his methods and either followed his manner or went to the same sources. Not infrequently, where the loan was from Virgil, pastoral writers adapted both the episode and the spirit which they had borrowed to the fashion of their own times.

Among contemporaries the most important work of fiction which demands attention in connection with the *Persiles* is Lope de Vega's *Peregrino en su patria,* since it too shows clearly that the Aeneid was looked upon, in all its essentials, as a romance. Lope defends[4] the nature of his hero's experiences and wanderings thus:

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[1] The Aeneid frequently occurs to Ariosto; cf. *Orlando,* Canto XIX, 35; XXXV, 25, etc.; Pio Rajna, *Le Fonti dell' Orlando Furioso,* (Firenze, 1876) and A. Romizi, *Le Fonti Latine dell' Orlando Furioso,* (Torino, 1896); Tasso, *Gerusalemme liberata,* Canto XVI, 40 ff.

[2] On the Spanish version of the *Arcadia,* cf. Menéndez y Pelayo, *Orígenes, etc., op. cit.,* p. cdxxvii.

[3] Cf. *Arcadia* di Jacobo Sannazaro secondo i manoscritti e le prime stampe con note ed introduzione di Michele Scherillo (Torino, 1888); *La Materia dell' Arcadia del Sannazaro,* studio di Francesco Torraca (Città di Castello, 1888).

[4] Cf. "Coleccion de las obras sueltas de Lope de Vega," Vol. V., edition Sancha (Madrid, 1776), p. 299 of *El Peregrino en su patria.*

. . . pues a ninguno parezca nuestro Peregrino fabuloso, pues en esta pintura no hay caballo con alas, Chimera de Belerophonte, dragones de Medea, manzanas de oro, ni palacios encantados: que desdichas de un peregrino, no solo son verisimiles, pero forzosamente verdaderas. Y si el poeta de Venusia, que Justo Lipso llama hijo de las Musas, pintó en los naufragios de Ulysses las transformaciones de Circe en los soldados Griegos que le acompañaban, y la espantosa estatura del gigante, que mató [sic] con el tizón ardiendo: y el Principe de los Poetas Latinos en la peregrinacion de Eneas pone tantas cosas fabulosas, hasta bajarle a los Campos Elysios, aunque esto hablando como Gentil, bien pudo ser que lo tuviesse por verdadero: pero en fin tranformó las naves, y levantó aquel testimonio a Dido con otros mil impossibles para exornacion de su Poema: de donde por ventura tomaron ocasion muchos para decir, que el argumento dél havia de ser de cosas falsas, ¿ por qué lo han de parecer, que una muger con dolor perdiesse el seso?[1] etc.

This practically means that taking Homer and Virgil as standards a novelist may introduce any episodes he sees fit to present, provided they seem probable and embellish the whole. Moreover, this and other references to the Aeneid are valuable testimony as to the general popularity of Virgil.[2]

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[1] Another important passage may be found in "Obras no dramáticas," p. 14, col. 1, *El desdichado por la honra,* in the nature of a justification of this type of story: "es muy proprio á los mayores años referir ejemplos, y de las cosas que han visto contar algunas; verdad que se hallará en Homero griego, y en Virgilio, latino, bastantes á mi crédito, por ser los príncipes de las dos mejores lenguas."

[2] *El Peregrino, op. cit.,* p. 335: "peregrinando en una pequeña parte de su patria España, con más diversidad de sucesos, que Eneas hasta Italia etc."; pp. 53, 64, 430, mere mention of Aeneas and Dido; p. 339, Aeneas and his son; p. 404: the escape from Troy, Aeneas carrying his father upon his shoulders; p. 306: a citation from Virgil (lo que Virgilio cuenta en aquellos versos), "Juntos Eneas y la triste Dido | van á cazar á un bosque," may be a modification of the already mentioned ballad beginning, "por los bosques de Cartago." Cf., however, bk. IV, v. 117, of the Aeneid; Lope's quotations generally render the Latin directly, though somewhat freely to suit his purpose; p. 31: "Ante sus ojos Hector triste en sueños," where *sus* should be *mis,* II, 270; further renderings of the kind are those in *La más prudente venganza,* "Obras no dramáticas" (Rivadeneyra) p. 24: "así despues habló, etc.," from the Aeneid VII, 135; and *Guzman el bravo,* p. 34: "si el cielo á los piadosos galardona," from the Aeneid I, 603-5. Reference to Virgil, the poet; *El Peregrino,* p. 341: "Maron y Homero en

At the outset mention was made of the importance of translations from the classics because of the assistance they rendered in the introduction of material from the Aeneid into later Renaissance literature. With regard to Cervantes, while there is no evidence that he could read Latin to any extent, there is no doubt that he knew Virgil in the translation of Gregorio Hernández Velasco, the one most widely current in his day.[1] Moreover, in view of the fact

la poesia príncipes," which is a common phrase; cf. also prologue to *la Circe;* in the dedication of the *Arcadia*, Virgil is the author of "sagrados versos . . . estupendo prognóstico de la venida de nuestra salud al mundo" (Fourth Eclogue); cf. also p. 129 of *Arcadia*, "obras no dramáticas."

Cf. Antonio de Eslava, *Noches de Invierno* (Barcelona, 1609), p. 40: "por buen termino me tratays de mentiroso, etc.," but the author's manner is justified, "que assi lo [mostraron] los celebres Poetas Homero y Virgilio, etc.," as though they were standards in fiction; p. 152: Dido's story; cf. also p. 176 for both versions of her story. Alonso J. de Salas Barbadillo, "Bibliófilos españoles" vol. XXXI, *El Necio bien afortunado*, p. 298, has an interesting passage: "Estaba diciendo á voces estos desatinos no sin causa: ¡ Oh grande hijo de Venus, héroe generoso, etc. (here follow some of the deeds of Aeneas), en todos esos hechos tenia competidores; . . . pero huir de una muger blanda y amorosa . . . nadie lo ha hecho sino tú, valiente Eneas. Tú solo . . . mereces el sonoro monumento . . . del gran Virgilio! ¡ Oh, si yo te imitara! etc." In *Alonso mozo de muchos amos*, by Jerónimo de Alcalá, there are two humorous references; bk. II, chap. 2, to Aeneas bearing Anchises upon his shoulders, II, chap. 5 to Dido. Montalban, *Para Todos* (7th day, "discurso último, que se llama lo mejor de lo mejor," par. 32) mentions among famous loving couples Dido and Aeneas, and Persiles and Sigismunda.

[1] Menéndez y Pelayo's article on *Traductores españoles de la Eneida* (2d vol. of Caro's translation, "Biblioteca clásica," Vols. IX and X) is so complete that little need be added. The doubt expressed about the existence of Natas's translation, i. e., of bk. II of the Aeneid (p. xiii), may be dispelled by Gallardo, *Ensayo, etc.*, Vol. III, col. 951; cf. also p. 486, n. 2. The long career of a Spanish Aeneid and its extensive popularity, notably during the greater part of the 16th and 17th centuries, can be inferred from the many editions mentioned by Menéndez y Pelayo, and, therefore, remain incontrovertible. Only the translation made by Gregorio Hernández concerns us here. In *El Peregrino curioso y grandezas de España* (16th century) por Bartholomé de Villalba y Estaña, "Bibliófilos españoles," Vol. XXIII (Madrid, 1886), the author first asserts "quan más castigados son los poetas que los otros auctores," and then adds, p. 28: "tanbien sobre Virgilio y el Homero traducidos dan votos insipientes; mas consentir en esto nada quiero, pues los dos vertidores son prudentes." Here the reference is manifestly to Hernández Velasco's version of the Aeneid, since he is

that Cervantes's general knowledge was chiefly of the world and of men and in no sense bookish, he cannot have looked upon the classics and purely academic learning with unmixed favor. We know that he deprecated the pedantic manner frequently enough indulged in by contemporaries, of parading a mass of irrelevant learning, of dragging into the text or scattering along the margin of the pages references to the ancients, to the Church fathers and the like. The prologue to *Don Quixote* leaves no room for doubt as to his opinion of such vanity.[1] And his distrust of the real learning of these pedants was justifiable, for the veriest numskull could quote Latin. But Cervantes was so wholly a master of the vernacular, so completely absorbed by the natural medium which his unschooled genius had chosen, that any effort to appear at home in Greek or Latin would have been forced.[2] Hence the sincerity of his defense of the poet in *Don Quixote,* who without artificial means, and unaided by the stimulus of learning, creates as a *mero romancista;* indeed the

praised in the next stanza as a poet and translator on the ground of his rendering (1569) of Sannazaro's *de partu Virginis.* Lope de Vega, on various occasions, praises Hernández's poetic gift; cf. *El Laurel de Apolo,* "acudiendo él primero, etc.," vs. 395 ff.; *Dorotea,* Vol. II of *Comedias escogidas,* p. 51, col. 2; *Virtud, pobrezo y muger,* Vol. IV, p. 214, col. 3; cf. Gallardo, *Ensayo, etc.,* Vol. I, col. 648; Clemencin in his edition of *Don Quixote, op. cit.,* II, chap. 62, note 61, quotes a severe passage from Cristóbal Suárez de Figueroa's *Plaza universal,* discourso 46: "testigos de esta verdad (of the wretchedness of various translations) pueden ser los desfigurados Ariosto, Taso y Virgilio, etc." It must be remembered, too, that the Aeneid in the original was a much edited work; cf. Ticknor, Vol. I, p. 451 and Sellar, *The Roman poets of the Augustan Age* (Oxford, 1877), p. 66.

[1] Cf. Cervantes, *el Coloquio de los perros,* where Berganza says: "hay algunos romancistas que en las conversaciones disparan de cuando en cuando con algun latin breve y compendioso, etc.," p. 232, col. 1, *Obras de Cervantes,* "Biblioteca de autores españoles."

[2] Navarrete, *Vida de Cervantes,* gives the latter credit for more classic learning that he had: "ni por esto perdió de vista á los excelentes maestros de la antigüedad, á quienes contempló siempre como el tipo ó dechado del mejor gusto en la literatura, segun se ve en las imitaciones que hizo de Apuleyo, de Heliodoro, de Horacio y de Virgilio." In his *Vida de Cervantes y analysis del Quixote,* prefixed to the Academy's edition of *Don Quixote,* the author, D. Vicente de los Rios, made a curious attempt to show that the latter contains parallels to the Aeneid; of vol. I, pp. xcv-vi, edition of 1782: "en las bodas del rico Camacho tienen los lectores un equivalente á los juegos y certámenes de las fábulas épicas; la morada de Don Quixote en casa de los Duques, corresponde perfectamente á la detención de Eneas en Cartago, etc." which no one believes to-day. Bowle, II, 120 of his

passage has the tone of a plea in behalf of his own work, which is so free from the dead wood of academic display.[1] His admiration of Homer and Virgil has, therefore, merely the traditional stamp of the Renaissance, while his praise of the ancients in general is per-

Anotaciones al Quixote sees a similarity between *Don Quixote* II, chapter 49, *toros y cañas* and Virgil, V, vs. 580, etc., of the Aneid; cf. also Ariosto, *Orlando*, 13, 37.

Cortejon's view, (cf. his edition of *Don Quixote* (Madrid, 1905), Vol. II, pp. xix ff.) that the bits of Latin quoted by Don Quixote are a proof of his, and so of Cervantes's knowledge of Latin, has no foundation; he gives among his examples such as *more turquesco, nulla est retentio (redemptio), quando caput dolet, bene quidem, pane lucrando, est Deus in nobis, per signum crucis, mare magnum* and the like. He even includes the well-known *post tenebras spero lucem* to be found on title pages before Cervantes's day, and the very common *deum de deo* (cf. Gaspar Lucas Hidalgo, *Dialogos*, II, chapter 3, and Cervantes, the *Coloquio de los perros*, p. 229, col. 1). Spanish children heard many Latin phrases from the mouths of the priests (on *habet borem in lingua*, cf. *Coloquio de los perros*, p. 233, col. 2), and not only in the schoolroom, but from the pulpit; Latin proverbs, such as *quando caput dolet, etc.*, were used no doubt in conversation, while our author could easily copy the phrases used by others with an equal display of learning. A few may be added to show how valueless their testimony as to Cervantes's learning is: *aliquando* (sic) *bonus dormitat Homerus* (*Don Quixote*, II, 3), *stultorum infinitus est numerus* (II, 3), *operibus credite, et non verbis* (II, 50), *sicut erat in principio* (I, 46), etc.; cf. also *El Rufian dichoso* for the *gloria patri;* these simply reflect the teaching of the priests; *Los Habladores:* "el proverbio latino no dice sino que *necessitas caret lege*, etc.;" *Persiles: María optimam partem elegit; vade retro, exi foras; La guarda cuidadosa: tu dixisti;* these fragments of Latin do not make a latinist. The verse of Virgil "quis talia fando . . . temperet a lacrimis," II, vs. 6-8, in *Don Quixote*, II, chap. 39, could have been taken from some other writer, and was always known well enough to have reached Cervantes by word of mouth.

[1] *Don Quixote*, II, 16: "Y á lo que decís, señor, que vuestro hijo no estima mucho la poesía de romance, doime á entender que no anda muy acertado en ello, y la razón es ésta: el grande Homero no escribió en latin, porque era griego; ni Virgilio no escribió en griego, etc. . . . del vientre de su madre el poeta natural sale poeta; y con aquella inclinacion que le dió el cielo, sin más estudio ni artificio compone cosas que hace verdadero al que dijo: *est Deus in nobis.*" Cf. also Lope de Vega, *El Verdadero Amante*, prologue; *Dorotea*, Vol. II, of "Comedias Escogidas," p. 33; Bowle, *Don Quixote*, part II, 42 cites Morales, *Sobre la lengua castellana*, p. 3, all containing the idea that, just as the Greeks wrote in Greek and the Romans in Latin, modern peoples should respect and use their own tongues.

functory and varies little from an inherited phraseology[1] in the manner in which it is expressed.

With regard to Virgil himself, Cervantes was probably impressed by the oft-repeated story which tells how the Aeneid had been in danger of being consigned to the flames after the poet's death, and how it was saved by his august patron, the Emperor;[2] but there is never a word on the poem which leads one to suspect that he knew it in the original. In general his allusions to Virgil and other classics, in which any display of learning may have been intended, are no clue to his classic education; they are merely a concession to his times. Moreover, it seems certain that Cervantes was to his immediate contemporaries, his neighbors and friends, an unimportant personage who did not shine by any erudition or social *savoir faire*, whose academic training was not great, and whose rank in society could not have been raised to any very high level during his checkered career as wanderer, slave, soldier and clerk. Like his great English contemporary, Shakespeare, he could claim no prominent social station, and as an inferior scholar he too had "small Latin and less Greek." Finally, as we shall see, all that Cervantes borrowed from the Aeneid could have been taken from Gregorio Hernández de Velasco's translation, and that he knew it well is fairly certain from quotations[3] and from similarities of phrase which will speak for themselves.

[1] Cf. *Galatea*, "Obras de Cervantes" (Rivadeneyra), p. 85, col. 2: "la [fama] que hará vivir el Mantuano Títiro por todos los siglos venideros, etc."; Pellicer and Clemenin saw in the position of Don Quixote at the end of I, chapter 43, an imitation of the situation of the enchanter Virgil, who was suspended in a basket. It is more likely patterned after some event in the romances of chivalry.

[2] Cf. *Don Quixote*, I, chapter 13; also an introductory poem of the Spanish version of the Aeneid: "El Emperador Augusto Cesar, sabiendo como Virgilio avia mandado en su testamento quemar la Eneyda, porque no la dejava tan limada como quisiera, hizo ciertos versos Latinos cuya sentencia es ésta"; then follows the poem.

[3] "Callaron todos, Tirios y Troyanos" (opening of book II of the Spanish version of the Aeneid) is supposed to represent the eagerness of the spectators gathered before the puppet theatre (*Don Quixote*, II, 26) to hear the story of Gaiferos and Melisendra, just as it did the interest of the Tyrians and Trojans who listened to the story of Aeneas. Clemencin, *Don Quixote, op. cit.*, Vol. VI, p. 158, calls the rest of the phrase, "pendientes estaban todos, etc.," a translation from the original. But the phrase is a common one, and Cervantes had used it before, I, chap. 51: "nos tenía

b. The Indebtedness of Cervantes.

After this rather lengthy excursion, let us examine the *Persiles* and investigate the extent of its indebtedness to Virgil. What has been stated was necessary to show that while Cervantes may have gone on his own initiative to the Aeneid for suggestions, still, imitations of well-known episodes or mere references to them were sufficiently traditional and common to prompt his taking the Aeneid as a kind of Renaissance *roman d'aventure* and using it, as he had done Heliodorus's *Theagenes and Chariklea,* wherever he saw fit to do so.

The story of the Aeneid may be divided into five main groups of episodes; the first three books are of the adventure type, with the flight of Aeneas, his wanderings and hardships; the fourth is a romance, the fifth is unique in its celebration of the games in honor of Anchises, the sixth relates the descent into the lower world, and finally, the last six books, which concern us little, consist chiefly of warfare attendant on the conquest of Italy by the Trojans. The most direct imitations in the *Persiles* are taken from the fourth and fifth books. The borrowing from the former may have been suggested by the popularity of that kind of love story, but there was a serious obstacle to incorporating successfully the tragedy of Dido. Owing to the high moral tone which Cervantes was bound to maintain in his romance because of the unimpeachable chastity of his hero and heroine—patterned, as we have seen, after Heliodorus—the opportunity to depict a real, living passion had to be eliminated throughout. It is moreover questionable whether Cervantes or any other Spanish writer of fiction of those days could have portrayed one. As a result, the mere skeleton of the Dido episode remains. Periandro, the hero, reaches the Kingdom of Policarpo in the course of his wanderings, in time to participate in some games. The princess Sinforosa—with a sister Policarpa, whose *raison d'être* seems to be Dido's having a sister Anna[1]—falls in love with the handsome guest. There is, to be sure, no chance of any requital of her love and a *parvulus Aeneas* would be wholly out of keeping with the kind of unions celebrated in this story. Not long after the meeting of

á todos la boca abierta pendientes de las hazañas que nos iba contando," p. 397, col. 1; cf. p. 503, n. 1; the line: "Que a osados favorece la Fortuna," *Eneida,* Vol. II, p. 115, is in *Don Quixote,* first poem with unfinished verse ends, line 19. Cf. also Appendix III, p. 522.

[1] In giving Dido a sister Anna, Virgil may have been influenced by the *Argonautica,* in which Medea has a sister, cf. Benoist, *Virgile, Enéide,* p. 191.

these two, the heroine Auristela and her party are wrecked on the island and the plot is duplicated inversely. Policarpo, the King, who is a widower, falls in love with the beautiful stranger, Auristela, and with the sexes changed we have an exact counterpart of the widow Dido and her love for Aeneas. In accordance with the curious taste of the day, the sentimental utterances of Dido on her situation are put into Policarpo's mouth.[1] As widower he has remained faithful to the memory of his dead spouse, but the coming of these "new guests" has disconcerted his equanimity. This is the counterpart of the effect produced on Sinforosa by Periandro, both incidents being copied from Dido's attitude toward her Trojan guest. Sinforosa in the meantime confesses her love for Periandro to his putative "sister" Auristela, who promptly becomes jealous. There is also in this the admixture of an episode from Heliodorus, where the victorious Theagenes first impresses Chariklea by his prowess in some games. While Periandro is on the island he is asked to tell the history of his experiences and wanderings, which

[1] All my quotations will be from Hernández de Velasco's *Eneida* (Valencia, 1776), 2 vols., which is a reprint of the editions revised by the translator himself (cf. the *licencia* in the edition of Toledo, 1577, and the introduction by the printer in the edition of 1776); and from the *Obras de Cervantes*, "Biblioteca de autores españoles" (Rivadeneyra); *Eneida*, Vol. I, p. 139: "la mal sana Reyna | Habla con su concorde y cara hermana. | Ana, mi dulce hermana, qué visiones | Turban mi sueño, y crecen mi cuidado? | Qué *nuevo huesped* vino á mis regiones? | Quién puede ser aqueste que he hospedado? | Qué rostro? qué persona? qué facciones? | Quán fuerte, ilustre, grave, y respetado? etc. | Sólo éste ha hecho fuerza al casto intento | Y mi animo hasta aora firme y fuerte | Vacilar hace en gran desasosiego. | Siento en mí un rastro del pasado fuego" (the italics are my own and indicate some of the similarities).

Persiles, p. 596, col. 1: "he guardado como has visto las leyes de la viudez con toda puntualidad y recato . . . pero despues que han venido estos *nueros huéspedes* á nuestra ciudad, se ha desconcertado el reloj de mi entendimiento . . . muero por Auristela, etc." Sinforosa's love for Periandro grows like Dido's: "dijole tambien como las gracias de [su hermano] Periandro habían despertado en ella un modo de deseo, que no llegaba á ser amor . . .; pero que después con la soledad y ociosidad, yendo y viniendo el pensamiento á contemplar sus gracias, el amor se le fué pintando, no como hombre particular, sino como á un príncipe . . . esta pintura me la grabó en el alma, y yo inadvertida dejé que me la grabase, etc.," p. 594, col. 1. *Eneida*, Vol. I, p. 144: "despues de divididos, en las horas | Que suele tomar vez la muda noche | . . . Sola ella en su espaciosa y viuda casa, | se consume, etc."

he does to a listening audience just as does Aeneas (*Aeneid,* bks. II and III); Sinforosa especially hangs on his lips during his narrative.[1] Following the main thread of the story through a maze of complicated love affairs, we learn that the foreigners (huespedes) plan a secret escape.[2] But Policarpo has in the meantime set fire to his palace; the city is in an uproar and the whole scene recalls in a general way the departure of the Trojans from Troy (*Aeneid,* bk. II) and from Carthage (*Aeneid,* bk. IV). The flames light up the city, din and confusion reign, mingled with shouts "to arms," while the fugitives gather in a small body ready to flee over the seas.[3] Sinforosa, however, in the midst of the uproar mounts with her sister to a tower of the palace and sees the fleeing strangers

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[1] *Eneida,* Vol. I, p. 49; "La desdichada Dido en largas pláticas | Dejava sin sentir pasar la noche, etc. | Mil cosas á menudo preguntando, etc. | Huesped; será á mi ver más acertado | Que del principio el Griego engaño digas: | Lo que has por tierra y mar peregrinado." p. 144: "otra vez hace | Contar la historia del Troyano duelo. | Y está otra vez la mísera colgada | Del dulce razonar del nuevo huesped."

Persiles, p. 604, col. 1: "Estando pues juntos . . . un día Sinforosa rogó encarecidamente á Periandro les contase algunos sucesos de su vida, especialmente se holgaria de saber de dónde venia la primera vez que llegó á aquella isla . . . A lo que Periandro respondió, que sí haría, si se le permitiese comenzar el cuento de su historia, no del mismo principio, etc." He then begins his story in the middle; also p. 608, col. 1: "La que con mas gusto escuchaba á Periandro era la bella Sinforosa, estando pendiente de sus palabras . . . tal era la gracia y donaire con que Periandro contaba sus sucesos." And p. 611, col. 2: "era tanto el deseo que Sinforosa tenia de oir el fin de la historia de Periandro, que solicitó el volverse á juntar otro día, etc." In the *Viaje del Parnaso,* II, v. 1, resembles the *Eneida:* "Colgado estaba de mi antigua boca | El dios hablante"; cf. also p. 500, n. 3.

[2] *Eneida,* Vol. I, p. 157: "mandales que luego | Las naos con gran secreto le aderecen, | Y a los Troyanos compañeros manden | Que al puerto al punto apriesa salgan todos, etc."; *Persiles,* p. 602, col. 1: "En resolución, quedaron los tres de acuerdo que Mauricio buscase un bajel de muchos que en el puerto estaban, que los llevase á Inglaterra secretamente, que para embarcarse no faltaria modo convenible, etc."

[3] *Eneida,* Vol. I, p. 68: "En tanto la ciudad en toda parte | Con vario lamentar se confundia." | p. 69: "Ya cerca y lejos la agua cristalina | Del pielago Sigeo arder parece. | Los gritos y el llorar de la mezquina | Gente, y el son de horrendas trompas crece."; p. 90: "Al arma, al arma, o mios, á la pelea."; p. 96: "La noche en fin lugar a Apolo dando, | Torneme á ver mi gente, etc." | "Gran suma de mancebos me esperavan | etc., que tristes

make their escape.[1] Her grief is voiced, as was Dido's, to her sister, in terms not so close to the original as was the lament in *Clareo y Florisea,* but in a way which more or less faithfully imitates its sentiments.[2] The fugitives make off in the meantime, while the

en monton confuso estaban, etc. | Con sus haciendas y animos mostravan | Que estavan á seguirme apercebidos."

Persiles, p. 616, col. 1: "Llegóse la noche, y á las tres horas della comenzó el arma, que puso en confusion y alborotó á toda la gente de la ciudad: comenzó á resplandecer el fuego, etc. Oyendo lo cual . . . se hicieron todos *un monton,* y puestos delante los varones . . . hallaron paso desembarazado hasta el puerto, etc. Entre la confusa gritería y continuo vocear al arma, al arma, entre los estallidos del fuego abrasador que . . . hacia el mayor estrago, andaba encubierto Policarpo, etc."

[1] *Encida,* Vol. I, p. 165: "O triste Dido, . . . | Que tal dolor sentias . . . quando | De tu alto alcazar la ribera toda | Vías hervir de perfidos Troyanos? | . . . o crudo amor, á qué no fuerza | Tu gran violencia á los mortales tristes?" p. 176: "Ya la purpurea Aurora, . . . de luz nueva | Las tierras cerca y lejos esparcia: | Quando la miserable Reyna vido | Desde una alta atalaya, . . . | que la armada con hinchadas velas | Se iba alejando, etc."

Persiles, p. 616, col. 1: "En esto la enamorada Sinforosa, ignorante del caso, puso el remedio en sus pies y su esperanza en su inocencia, y con pasos desconcertados y temerosos se subió á una alta torre de palacio, á su parecer parte segura del fuego: . . . acertó á encerrarse con ella su hermana Policarpa, que le contó . . . la huída de sus huespedes, cuyas nuevas quitaron el sentido á Sinforosa, etc."

[2] *Encida,* Vol. I, p. 159: "Huesped mio, porqué, ó á do te alejas? | En cuyos brazos á morir me dejas? etc."; p. 162: "Tú del horrido Caucaso naciste, |El te dió esa alma dura y peñascosa: | Y si esto no es, las Tigres te engendraron | De Hircania, etc.;" p. 165: "Ves, Ana mia, qual van todos bolando, | De toda parte al puerto se han juntado: | Las velas ya al buen viento están llamando, etc."; p. 166: "Que espere ya para huir buen viento, | Por su interese ha esto de otorgarme, | Que la quebrada fe del casamiento | ya no le rogaré quiera guardarme, etc. | Un breve tiempo pido, si es posible, | En que se haga mi furor sufrible, etc. | Esto te pido (to her sister) por merced crecida; | Ten lastima á mi duelo acerbo y fuerte: | No serás ya de oy más de mí afligida, | No te cansaré más hasta la muerte, etc."; p. 171: "fugitivo Eneas."

Persiles, p. 616, col. 2: "sola Sinforosa se estaba aun en su desmayo, y sola su hermana lloraba su desgracia . . .; volvió en fin, tendió la vista por el mar, vió volar la saetía donde iba la mitad de su alma . . . , y como si fuera otra engañada y nueva Dido, que de otro *fugitivo Eneas* se quejaba, enviando suspiros al cielo . . . dijo estas ó otras semejantes razones: Oh hermoso huésped venido por mi mal á estas riberas, no engañador por cierto, que aun no he sido yo tan dichosa, que me dijeses palabras amorosas para engañarme, amaina esas velas, ó

palace is consumed by the fire. This episode of the *Persiles,* however, verges on the ludicrous on account of the absurd duplication of the incident. Policarpo also appears in the tower and beholds his love disappear over the waters, but fortunately there is no lamentation.[1]

Further indebtedness to the story of Dido can no doubt be exaggerated,[2] and while there are in the *Persiles* certain very insignificant sentiments or situations which may have been slightly affected by the fourth book of the Aeneid, it is more probable that they are independent similarities. When, for instance, Arnaldo, a prince in love with Auristela, is detained by her charms instead of going home to his kingdom, he is advised by the busybody Clodio to be mindful of his duties and proceed on his journey to his own country. Just so Aeneas had been reminded of his duty in regard to the future of his race in Italy by a messenger from the gods, who urges him to leave Carthage.[3] Clodio is a kind of personified rumor (*fama* in the Aeneid), who gossips about the possible, secret relations between the hero and heroine and the scandal of Arnaldo's continuous hovering about Auristela. Again, the attractions which keep Aeneas at

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témplalas algun tanto, para que se dilate el tiempo de que mis ojos vean ese navío . . . mira, señor, que huyes de quien te sigue . . .: hija soy de un rey, y me contento con ser esclava tuya; y si no tengo hermosura que pueda satisfacer á tus ojos, tengo deseos que puedan llenar los vacíos de los mejores que el amor tiene . . . riquezas tengo, acelerado fugitivo mio . . . A esta sazon volvió á hablar con su hermana, y le dijo: No te parece, hermana mía, que ha amainado algun tanto las velas? No te parece que no camina tanto? Ay Dios, si se habrá arrepentido! . . . Ay hermana, respondió Policarpa, no te engañes . . . el navío vuela, etc." Cf. also (p. 602, col. 1) "habiendote criado . . . entre riscos y peñas, de las cuales . . . has sacado tambien la dureza en las entrañas."

[1] *Persiles,* p. 616, col. 2: "Salteólas en esto el Rey su padre, que quiso ver de la alta torre, tambien como su hija, no la mitad, sino toda su alma, que se le ausentaba, etc."

[2] Certain resemblances to features of *Theagenes and Chariklea* would be hard to distinguish from a possible indebtedness to the Aeneid, where the nature of the episode or the sentiment is the same.

[3] *Eneida,* Vol. I, p. 156: "Que estás tú agora, Eneas, muy marido, etc. | Fundas (o gran vergüenza) ageno nido, | Tu Reyno, tu valor, y á tí olvidando? etc. | Qué haces, dí, en la Libia tierra ocioso? etc." *Persiles,* p. 595, col. 1: "quiero que tal vez consideres qûién eres, la soledad de tu padre, la falta que haces á tus vasallos, la contingencia en que te pones de perder tu reino, etc."

the side of Dido, the opportunity for a desirable match, for gaining the power over a fine kingdom resemble those held up before Periandro by Auristela to urge him to stay and marry Sinforosa.[1] At other times there is a possible fusion of the spirit of Heliodorus with that of Virgil; as Theagenes and Chariklea pursue a certain goal, as Aeneas flies from Carthage that he may fulfil the purpose of his wanderings, so Periandro and Auristela are determined to carry out their journey to Rome. All escape from the snares of love. In their striking appearance, their beauty and noble bearing, the protagonists of these romances are of course alike, and Aeneas and Dido, Theagenes and Chariklea, Periandro and Auristela quite naturally came to be mentioned together in lists of loving couples.[2] Finally, the incantations of the Massylian enchantress by whose aid Dido seeks to regain the lost love of Aeneas must be considered[3] together

[1] *Persiles*, p. 595, col. 2: "digo que Sinforosa te adora y te quiere por esposo: dice que tiene riquezas increibles, y yo digo que tiene creible hermosura."

[2] Cf. p. 496, n. 2, end: in Montalban's *Para Todos*. The appearance of Aeneas, *Eneida*, Vol. I, p. 39: "Quedó patente el bello y fuerte Eneas, | y semejante á Dios en rostro y cuerpo, | Resplandeció, etc."; p. 148: "Eneas, sobre todos hermosisimo | . . . Qual va el hermoso Apolo, quando deja | A la templada Licia, etc." The appearance of Dido, p. 34: "Qual suele en las riberas del Eurota, | . . . Salir Diana á recrearse en corros, | . . . tal era Dido, etc." For the *Persiles*, cf. previous article, op. cit., Appendix, par. 7; Periandro's beauty is described, p. 588, col. 2; Auristela is like a goddess, p. 604, col. 2.

[3] *Eneida*, Vol. I, p. 169-70: "Hallado he, hermana mia, ya manera, etc., | Con que mi Eneas mas que á sí me quiera, etc. | Ay un lugar do el Sol de nos se parte, | Al fin de Etiopia . . . | De allí yo he visto aquí una religiosa | Masila, que ha por largos dias guardado | De las hijas de Atlante la famosa | Casa, etc. Esta con sus encantos se profiere | A atar y a libertar los corazones: | Sana el insano amor a los que quiere, etc.;" p. 257: "la Cumea Sibila | Derramó dulces y olorosos vinos: | Y de en mitad de los noveles cuernos | Cortóles ciertas cerdas, y entrególas | Al sacro fuego por primera ofrenda, Llamando con voz alta á la grande Hécate, etc."; cf. also bk. VII, p. 320 ff., "la furia Alecto . . . arrebatando una culebra | Que arrancó del cabello serpentino, | Con furia la arrojó á la Reyna Amata, etc.," and the subsequent actions of the queen; cf. also Eclogue viii.

Persiles, p. 602, col. 2: "Has de saber ansimismo que en aquella ciudad de Alhama siempre ha habido alguna mujer de mi nombre, la cual con el apellido de Cenotia hereda esta ciencia, que no nos enseña á ser hechiceras, como algunos nos llaman, sino á ser encantadoras y magas," with the distinction between the two given at length. She tries her charms on Antonio, p. 603 ff.

with the love philtres, enchantments and the like, which serve similar purposes in sixteenth century romances. In the *Persiles* the corresponding part in the above mentioned love affairs is taken by the old hag Zenotia.

Having examined the age of Cervantes we see, therefore, that the great passion of Dido with its splendid exposition and vividness exerted influence on the sentimental fiction of the entire sixteenth century; nowhere is there a more forceful description of the "love-sickness" which characterizes so many Renaissance heroines than in the fourth book of the Aeneid.[1]

Sinforosa falls in love with the handsome stranger at the celebration of festal games. The idea of using such an opportunity to bring together hero and heroine goes back, as we have seen, to Heliodorus and the Greek romances;[2] but nowhere among the latter would Cervantes have found any festivities as fully described as those which he gives. He felt, no doubt, that in order to present his hero in the most advantageous light, with strength and beauty, he must dwell more extensively than his predecessors on his athletic superiority and skill. To this end he may have cast about for suggestions and so have come upon the Aeneid.[3] The fifth book with its funeral games had already been frequently imitated, and a similar contest in which the hero outstripped all competitors and gained all prizes, must have seemed appropriate for his novel also. Their adoption was therefore no more an innovation than the use of Dido's story; they had already been taken out of their original setting in Homer[4] and Virgil by writers of fiction to serve as enter-

[1] *Eneida,* Vol. I, p. 144: "Quando los astros que del cielo bajan | Embian al mundo el sueño y el silencio, | Sola ella en su espaciosa y viuda casa, | Se aflige, se consume, y se deshace, | Sobre su viudo estrado se reclina, etc." *Persiles,* p. 593, col. 1 ff., illness of Auristela.

[2] Cf. Rohde, *op. cit.,* p. 155 ff.

[3] Mena's Heliodorus has a marginal reference to the games in the Aeneid; cf. p. 475, n. 2.

[4] In Homer, *Iliad,* XXIII, the contests are: (1) chariot, with five prizes; (2) boxing (or *pugilato* in a recent Spanish version), with two competitors; (3) wrestling or *lucha,* with two competitors; (4) foot race, with three competitors; (5) duel with spears, with two competitors; (6) hurling of great weights of metal, with four competitors; (7) shooting, with two competitors; in the *Odyssey,* VIII, there is a reference to games, foot race, wrestling, leaping, throwing of weights and boxing; Theocritus, Idyl 22, describes a boxing-match which influenced Virgil's contest, bk. V; for

tainment at various kinds of festivals. From the earlier days of the Renaissance in Italy, story and romance which followed in the footsteps of the classics had contented themselves as regards these games with a mere mention of a celebration of sports, or had actually incorporated the events of the fifth book quite fully.[1] The best example of the latter is Sannazaro's *Arcadia*. But the episode in which Ergasto celebrates his mother's funeral,[2] though closely pat-

the same contest cf. Apollonius Rhodius, *Argonautica*, II; Statius, Thebaid, VI, describes funeral games including a chariot race, a foot race, throwing the discus, a combat with the cestus, wrestling and shooting; Valerius Flaccus, *Argonautica*, IV, 252 ff. has a boxing match; Quintus of Smyrna, *Posthomerica*, bk. IV, follows Homer in introducing funeral games, containing a foot race, boxing, hurling a mass of iron, leaping and throwing the spear, a chariot race and a race on horseback; Apollonius of Tyre wins popular favor by his skill in the game of ball, cf. *Historia Apollonii Regis Tyri*, edit. Ring, Posonii, et Lipsiae, 1887, par. 13 ff.; Rohde, *op. cit.*, p. 437; also Timoneda, *Patrañuelo*, XI for same story, p. 145 of "Novelistas anteriores á Cervantes" (Rivadeneyra).

Nothing more unlike the usual Spanish festivities than these games could be found in Peninsular literature, though pictures of entertainments are frequent enough. The Spaniard has always been fond of pageantry, of picturesque processions, of animated *fiestas*, while his games or amusements were correspondingly stirring, from the bull-fight down through skill in *correr cañas, correr sortijas, justas, torneos* and even *correr gansos* (Lope de Vega, MS. of *la dama boba*, act I). Cf. Alcocer, *Tratado del juego* (Salamanca, 1559); *Don Quixóte*, II, 17 and notes 28 and 30 of Clemencín's edition; II, 49 with a mention of *correr toros, jugar cañas, y representar comedias;* Bowle, in Comments on *Don Quixote* II, p. 120, compares the *correr toros, etc.* of this passage with Virgil, Aeneid, V, 580, but without sufficient reason: "olli discurrere pares, etc." Clemencín has an interesting note on the fondness shown in *la Mancha* for wrestling, *Don Quixote*, II, 60, note 10; cf. also II, 62 *correr sortija;* Alarcón, *las Paredes oyen*, II, scene 1, mention of a kind of *pelota;* common amusements were the *fiestas* by the bank of the river, cf. *Guzman de Alfarache*, II, 3, 5: "llevábanos á todos á holguras, á cenar al rió, á comer en quintas y jardines, las tardes á comedias, etc." Quevedo, *Vida del Buscón*, II, chapters 6 and 7; Alarcón, *la Verdad sospechosa*, I, scene 7; J. R. Chorley, "Notes on the national drama of Spain, "*Fraser's Magazine*, Vol. 60, p. 70; typical *ejercicios caballerescos* are mentioned in the *Caballero Cifar*, "el tiro de la lanza, la cetrería, los juegos de tablas y ajedrez": cf. Menéndez y Pelayo, *Orígenes, etc., op. cit.*, p. cxc; for jousts cf. *Question de amor* (1513), also for picturesque costumes and a hunting scene.

[1] Cf. Appendix IV, p. 523.

[2] Prose sections X-XI; cf. Scherillo, *op. cit.*, Torraca, *op. cit.*, and Menéndez Pelayo, *Orígenes, etc.*, pp. cdxxiv ff.

terned after Virgil, probably had no influence upon Cervantes. Whether Sannazaro suggested Virgil to him or not, is a gratuitous question which we have no means of answering. Moreover, those novels of the sixteenth century which occasionally mention sports without describing them at length, may have sufficed to induce Cervantes to borrow Virgil's games.

Sports are spoken of especially often in the pastoral novel, and since occasional parts of the *Persiles* have the tone of the *Galatea,* the introduction into the former of long descriptions of games which were merely mentioned in the latter and other pastorals, may have seemed like a commendable venture. Cervantes, however, does not seem to have felt perfectly sure that irrelevant description of races and the like would be of interest to his readers, for on one or two occasions he criticizes their detailed rehearsal in a way which sounds something like a humorous self-reproach.[1]

The games in the fifth book of the Aeneid have been used in two distinct places. In the first (bk. I, ch. 22 of the *Persiles*), Periandro arrives at the island of Policarpo with twelve companions, "todos nobles y deseosos de ganar honra." He competes in various contests, first, the foot race, second, in fencing, third, in wrestling, fourth, in hurling a heavy bar, and lastly, shooting with cross-bow and arrow. In each he is victorious. The corresponding passages, grouped together, will show with what variations from the Aeneid these matches are introduced in the *Persiles.*[2] Cervantes leads up to the episode, which he supposes to be perfectly in keeping with the customs of the unknown northern islanders of whom he speaks, by telling of their excellent system of government, their superior laws, their splendid kings. The latter devise public festivals to keep their vassals in a good temper:

Los reyes, por parecerles que la melancolía en los vasallos suele despertar malos pensamientos, procuran tener alegre el pueblo y entretenido con fiestas públicas, y á veces con ordinarias comedias; principalmente solemnizaban el día que fueron asumptos al reino,

[1] *Persiles,* p. 607, col. 1: "hubieran perdido [la paciencia] escuchando su larga plática, de quien juzgaron Mauricio y Ladislao que habia sido algo larga y traida no muy á propósito, etc."; and p. 611, col. 2: "Paréceme, Transila, que con menos palabras y mas sucintos discursos pudiera Periandro contar los de su vida, porque no había para qué detenerse en decirnos tan por extenso las fiestas de las barcas."

[2] Cf. Appendix V, p. 525.

con hacer que se renovasen los juegos, que los gentiles llamaban olímpicos, en el mejor modo que podían: señalaban premio á los corredores, honraban á los diestros, coronaban á los tiradores, y subían al cielo de la alabanza á los que derribaban á otros en la tierra.

At this point a possible fusion of the influence of both Virgil and Heliodorus takes place. In Heliodorus the festivities are given over to Pythian games; Cervantes may have taken a suggestion from this fact, and while looking for the most classical material that could be turned into "Olympian" games, he had recourse to the Aeneid.

The first event in Virgil's games, the boat-race, fills a single episode in the *Persiles* quite independent of the other above. It is put into a purely pastoral setting upon an island in the northern seas, among some fisher folk who differ in no respect from the characters of the pastoral novels. At the marriage festival of two young couples a race is rowed by four boats just as in the Aeneid,[1] though the naming of the boats *el Amor, el Interés, la Diligencia,* and *la buena Fortuna* is not in keeping with their classic origin. It recalls rather the pageant at the marriage feast of Comacho in *Don Quixote,*[2] where two competing groups of dancers are led by *Amor* and by *Interés.* A comparison of this scene in the *Persiles* with its source will show the extent of Cervantes's indebtedness and how he took the salient ideas.

When Aeneas lands on the coast of Africa, he comes upon the Carthaginians engaged in building their city; he wanders into a great temple and sees within it a pictorial history of the events connected with the Trojan war. Here are recorded the battles before the city[3] and the fate or career of the chief participants

[1] Cf. Appendix VI, p. 530.

[2] Cf. *Don Quixote,* II, chapter 20 and Clemencin's edition, *op. cit.,* Vol. VI, p. 32.

[3] *Eneida,* Vol. I, p. 31: "Mientras que entre sí alaba el artificio | De los ingeniosisimos artifices, | Y las *labores* y obras de sus manos: | Vido a desora entre ellas las batallas | Troyanas, dibujadas por su orden, | Y la prolija guerra, etc." "A Priamo mira, a quien del justo zelo | Le da, aun aqui, su premio la pintura: | Mira los llantos del Troyano duelo, etc." "Via *pintados* los reencuentros | Que en torno a la gran Troya se travaron: | En un lugar los Griegos ir huyendo, | Y la Troyana juventud seguirlos, etc." "No lejos conoció los blancos lienzos | De la curiosa tienda del Rey Reso. . . . *En otra parte,* el infelice mozo | Troylo, con gran desigualdad

separately portrayed. Again, in the sixth book of the Aeneid we are told of a temple of Phoebus on whose doors Daedalus had painted various famous mythological episodes.[1] Now when Periandro and his fellow wanderers have ended the first half of their long and wearisome peregrination among the islands of the northern seas, they disembark at Lisbon. One of the first things which the hero does is to order a painting which shall reproduce the hardships just endured, "los mas principales casos de su historia." Then follows a description of events which recalls the pictorial history of the Aeneid.[2] In another passage one of the characters suggests that further incidents of their journey overland be added to the others on the canvas; but the pilgrims are of the opinion that such strange experiences ought rather to be engraven on bronze.[3] This reference seems to recall the classics which occasionally recount like representations[4] in metal or stone. In addition, Cervantes had in

travado | En duro asalto con el fuerte Achiles, etc." "Alli tambien *se conoció a sí mesmo* | Entre los Griegos principes mezclado." Cf. also *Eneida*, libro quinto, p. 201, the "tela de oro" with its picture inwoven.

[1] *Eneida*, Vol. I, p. 243: "Pintó en las puertas dél, la acerba muerte de Androgeo, etc." Cf. also Torraca, *La Materia dell' Arcadia del Sannazaro*, p. 102.

[2] *Persiles*, p. 625, col. 1: "á un lado *pintó* la isla bárbara ardiendo en llamas, y allí junto á la isla de la prision y un poco más desviado la balsa ó enmaderamiento donde le halló Arnaldo, cuando le llevó á su navió; *en otra parte* estaba la isla nevada, donde el enamorado portugués perdió la vida; luego la nave que los soldados de Arnaldo taladraron; . . . allí se mostraba el desafío de los amantes de Taurisa y su muerte, acá estaban serrando por la quilla la nave que habia servido de sepultura á Auristela y á los que con ella venian; acullá estaba la agradable isla donde vió en sueños Periandro los dos escuadrones de virtudes y vicios, etc.; pintó como en rasguño y en estrecho espacio las fiestas de Policarpo, *coronandose á sí mismo* por vencedor en ellas: resolutamente no quedó paso principal en que no hiciese *labor* en su historia, que allí no pintase, hasta poner la ciudad de Lisboa y su desembarcacion en el mismo traje en que habian venido: tambien se vió en el mismo lienzo arder la isla de Policarpo, á Clodio traspasado con la saeta de Antonio, y á Cenotia colgada de una entena, etc."

[3] *Persiles*, p. 641, col. 2: "Bien quisiera el anciano Villaseñor, que todo esto se añadiera al lienzo; pero todos fueron de parecer que no solamente no se añadiese, sino que aun lo pintado se borrase, porque tan grandes y tan no vistas cosas no eran para andar en lienzos débiles, sino en láminas de bronce escritas y en las memorias de las gentes grabadas."

[4] Cf. the shield of Achilles, made by Vulcan (*Iliad*, XVIII); the shield of Aeneas (*Aeneid*, VIII), which may also have influenced Cervantes, *Eneida*,

mind a contemporary custom which he describes at length; namely, that pilgrims who returned from foreign parts,[1] presumably after great hardships, would display pictorially on canvas the experiences which they may or may not have had, but which would attract idlers on the public square. The canvas was exhibited in the chief thoroughfares where the many travelers' tales of the age were retailed to the gaping multitude. Cervantes devotes a humorous page to such an episode, which has, however, a wholly Spanish, popular tone,[2] while he treats Periandro's pictorial history with so much

Vol. II, p. 40; Ovid (*Met.* II), has a description of the palace of the sun; Statius (*Thebaid,* VII) of the temple of Mars with carved representations. Not only Cervantes, but Ariosto (*Orlando furioso,* XXVI, 30 ff.) in a marble basin and (XLVI, 80 ff.) a pavilion, Tasso (*Gerusalemme liberata,* XVII, 64 ff.) in a shield, and Spenser (*Fairie Queene,* II, xii, 43 ff.) in a carved ivory gate show the influence of the classics.

[1] *Persiles,* p. 597, col. 1: "y este nuestro bárbaro español, . . . yo pondré que si el cielo le lleva á su patria, que ha de hacer corrillos de gente, mostrando á su mujer y á sus hijos envueltos en sus pellejos, pintando la isla bárbara en un lienzo, y señalando con una vara el lugar do estuvo encerrado quince años, la mazmorra de los prisioneros . . . bien así como hacen los que libres de la esclavitud turquesca . . . cuentan sus desventuras, etc."; p. 625, col. 1: "este lienzo se hacia de una recopilacion que les excusaba de contar su historia por menudo, porque Antonio el mozo declaraba las pinturas y los sucesos, cuando le apretaban á que los dijese." An interesting parallel to this custom can be found in the following: *Aulo Persio Flacco,* traduzido en lengua castellana por Diego Lopez, etc., Con declaracion magistral, etc. En Burgos, 1609. In commenting on a passage in the first satire, "mene moueat quippe et si naufragus cantat pretulerim assem?" Diego Lopez says, p. 42: "Para entender esto, auemos de saber, que quando entre los antiguos alguno se via perdido, y desbaratado en alguna tormenta, si escapaua de ella, buscaua un pintor que le pintasse en un pedaço de tabla la tormenta y tempestad que auia passado, y como el mar le auia destruydo, y echandole al cuello, andaua pidiendo por las calles. Pues, dize Persio, si el que pide leuando la tormenta pintada, la qual passo un el mar, canta, y va contento, es impossible que me mueua a compassion y dolor, para que yo le de limosna, etc."

[2] *Persiles,* p. 642, col. 1: "vieron mucha gente junta, todos atentos mirando y escuchando á dos mancebos, que en traje de recien rescatados de cautivos estaban declarando las figuras de un pintado lienzo que tenian tendido en el suelo . . .; y uno de ellos, que debia de ser de hasta veinticuatro años, con voz clara y en todo extremo experta lengua, crujiendo de cuando en cuando un corbacho, ó por mejor decir, azote, que en la mano tenia, le sacudia de manera que penetraba los oidos y ponia los estallidos en el cielo . . . fué diciendo: Esta, señores, que aquí veis pintada, es la ciudad de Argel, gomia y tarasca de todas las riberas del Mar Mediterraneo, etc."

seriousness and dignity, that it seems certain that he had the Aeneid in mind when he described it.

As was indicated above, another of the traditionally popular experiences of Aeneas was his descent into the lower world; and we have seen that it was a feature quite common with the type of romance to which the *Persiles* belongs, to represent the hero as meeting some one who prophesies to him of coming events. There is, to be sure, no descent into Hades in Cervantes, but the hero and his fellow wanderers are conducted by an old man through a dark cave into a beautiful, secluded field.[1] Here the venerable man, a hermit, resides in peace and plenty, with his mind wholly set on lofty things; the talk and the ways of the world are to him things of the past, while his thoughts are devoted to the contemplation of the heavens and future events. Among those who figure in his prophesy is a young prince who dies an untimely death; and this recalls the well-known passage of Virgil which tells so pathetically of the death

[1] *Eneida,* Vol. I, p. 281: "Siguiendo su camino, en fin llegaron | A los lugares dulces, y vergeles | Amenos, de los bosques gloriosos, | Albergos y moradas de los buenos. | Aqui *el risueño y rutilante Cielo,* | Viste con luz purpurea el campo alegre." p. 284: "Ellos dejando la alta cumbre, bajan | A un *verde valle,* donde el padre Anchises | Avia juntado en cierto apartamiento | Las almas de sus claros descendientes, etc." He explains, "Porque parece claro desvarío | Trocar en descontento y cierto duelo | De que abunda el impuro y vil terreno, | La gloria eterna deste *sitio ameno,*" and prophesies to his son: "Contarte he extensamente | El gran linage y descension Troyana."

Persiles, p. 656, col. 1: "Soldino con todo aquel escuadron de damas y caballeros bajó por las gradas de la escura cueva, y á menos de ochenta gradas se descubrió *el ciclo luciente* y claro, y se vieron *unos amenos* y *tendidos prados* que entretenian la vista y alegraban las almas; y haciendo Soldino rueda de los que con él habian bajado, les dijo: . . . esta cueva . . . no sirve sino de atajo para llegar desde allá arriba á *este valle* . . .; aquí huyendo de la guerra, hallê la paz; la hambre que en ese mundo de allá arriba . . . tenia, halló aquí á la hartura; aquí en lugar de los principes y monarcas que mandaban en el mundo, á quien yo servia, he hallado á estos arboles mudos, que aunque altos y pomposos son humildes; . . . aquí tengo mi alma en mi palma, y aquí por via recta encamino mis pensamientos y mis deseos al cielo; aqui . . . he contemplado el curso de las estrellas y el movimiento del sol y de la luna; . . . agora como presente veo quitar la cabeza á un valiente pirata un valeroso mancebo de la casa de Austria naeido, etc.," with other prophesies. For further examples of this kind of prediction see *Persiles,* p. 645, col. 1; p. 669, col. 1; for a description of "unos floridos campos" more beautiful than the Elysian fields, cf. *Don Quixote,* I, chapter 50, p. 394, col. 2.

of young Marcellus.[1] Those lines were no doubt much liked in the days of Cervantes. Other prophesies concerning the personages of the story follow. Here, too, Cervantes is inclined to ridicule himself for introducing this kind of episode with its forecasts and clairvoyance.[2]

Among the minor episodes of the *Persiles* which do not necessarily imply indebtedness to Virgil, but which might, after all, be considered by some as reminiscent of the Aeneid, is the death and burial of Auristela's nurse (ama), a circumstance which recalls the fate of Aeneas's nurse,[3] as well as other episodes of burial in the

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[1] *Eneida*, Vol. I, p. 295: "Padre, quién es aquel, que en compañia | Va del varon que dices excelente? | . . . Es *hijo o nieto nuestro*, etc.? Ay, hijo, no escudriñes el lamento | De tu linaje y casos lastimosos: | A aqueste mostrarán solo un momento | A las tierras los hados rigurosos, | etc. O quánto llanto (o misero destino) | Hará por éste la Romana gente, | etc. Ay miserable mozo, o suerte fiera, | Si el disponer de la Fortuna avara, | Del hado adverso, y riguroso Cielo | Romper pudieses, tu serias Marcelo."

Persiles, p. 656, col. 2: "Pero, ay de mí, que me hace entristecer otro coronado jóven, tendido en la seca arena, de mil moras lanzas atravesado, el *uno nieto* y el otro *hijo* del rayo espantoso de la guerra, jamas como se debe alabado Carlos Quinto, etc." There is possibly an indirect connection between the descent of Don Quixote into the cave of Montesinos and the numerous descents into the cave of the Cumaean Sibyl or into the lower world to be found in Renaissance literature; cf. Clemencin, edition of *Don Quixote, op. cit.*, II, chapter 23, Vol. VI, p. 76.

[2] *Persiles*, p. 657, col. 1: "parecíales que andaban rodeados de adivinanzas y metidos hasta el alma en la judiciaria astrologia, que á no ser acreditada con la experiencia, con dificultad le dieran crédito."

[3] *Eneida*, Vol. I, p. 299: "Tú tambien, o Cayeta, *ama de Eneas*, | Diste perpetuo nombre y fama eterna, | Muriendo, a nuestras Italas riberas. | Y tu gloria y honor hasta oy aun dura | En tu sepulcro, etc." "El pio Eneas, hechas las exequias | De su nutriz, y su Mausoleo puesto, | . . . Las velas tiende al viento, etc." p. 102: "La deuda funeral pues ya pagada, | Todos la voz en alto grito alzamos, | Diciendo una vez y otra y la tercera | El *Vale*, despedida postrimera." p. 255: "En tanto en la ribera los Troyanos | Hacian su llanto por el buen Miseno, | Honrando con exequias postrimeras | El cuerpo muerto . . . Lustró con agua pura por tres veces | Sus compañeros todos, . . . y dijo al muerto amigo | *El postrimero Vale* para siempre. | Fundóle el pio Eneas un sepulcro, etc."

Persiles, p. 568, col. 2: "Llegóse á ella Auristela, y á voces compasivas y dolorosas le dijo: ¿Qué es esto, ama mia? ¿Cómo, y es posible que me quereis dejar en esta soledad, etc?" p. 569, col. 1: "enterraron á Cloelia en lo hueco de una peña . . . Auristela (le) rogó que le pusiese una cruz encima . . . El español respondió que él traeria una gran cruz que en su estancia tenia, y la pondria encima de aquella sepultura:

Aeneid. The incident is dragged into the narrative of the *Persiles* quite irrelevantly, but a pathetic note is added thereby to suit the sentimental taste of contemporary readers. Then there is the poetic figure of Palinurus, the pilot of Aeneas's fleet, the star-gazer and weather prophet, who is mentioned in *Don Quixote* and whose part might seem to be faintly reflected in similar situations in the *Persiles.*[1] Periandro watches the heavens at sea while the others sleep; Mauricio, too, is a star-gazer, though he is more of an astrologer than pilot.[2]

Finally, some of the very general features of Virgil's epic romance of adventure are recalled by the manner of the *Persiles;* their occasional resemblance to the machinery of Heliodorus will also be apparent at once, and though the latter's influence may have been dominant, the Aeneid played no insignificant part in affecting the general character of the novel of Cervantes. The parallels to illustrate this are grouped together at the close of the article.[3] By comparing them in turn with those from Heliodorus in the previous article, students of fiction may possibly feel inclined to believe with me that the influence of Virgil upon Heliodorus also is worthy of more consideration than has hitherto been accorded it.

The marked influence which was exerted upon the mind of Cervantes by one of the important elements in the literary culture of

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diéronle todos *el ultimo vale,* etc." p. 570, col. 2: "quiso Auristela ir á despedirse de los huesos de su querida Cloelia, acompañáronla todos, lloró sobre la sepultura, etc." Cf. also *el Viaje del Parnaso,* cap, iii, vs. 145-7: "Vimonos en un punto en el paraje | Do la nutriz de Eneas piadoso | Hizo el forzoso y último pasaje."

[1] *Encida,* Vol. I, p. 110: "las naos . . . van ciegas do los vientos las llevavan | Ni el mesmo Palinuro determina | Si es de dia o noche o para do camina; and p. 127: "Al medio Cielo se iva ya acercando | La presurosa noche, quando vimos | A Palinuro apriesa en pie ponerse, | Y a un lado y otro a tierra y mar bolverse. | Azia todos los vientos se bolvia, | . . . Notava la estrellada compañia, etc." *Persiles,* p. 613, col. 1: "Llegó en esto la noche clara y serena, y . . . me senté en el castillo de popa, y con ojos atentos me puse á mirar el cielo." *Don Quixote,* I, 43: "Siguiendo voy á una estrella | que desde lejos descubro, | más bella y resplandeciente | que cuantas vió Palinuro."

[2] *Persiles,* p. 583, col. 1: "Puso los ojos en el cielo Mauricio, etc."; p. 585, col. 2: "miraba las estrellas, y aunque no parecian de todo en todo, algunas que por entre la escuridad se mostraban le daban indicio de venidera serenidad, etc."

[3] Cf. Appendix VII, p. 534.

the Renaissance, namely, by the poetry of Virgil, is now quite evident. The more we try to fathom the depths of the Spanish romancer's genius, the more we shall find how comprehensively his work reflects all the elements which constitute the culture of his age; and, therefore, we shall become convinced that the classics which had been more or less incorporated into the literature of his day merit the most careful consideration.

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APPENDIX I.

The two versions of the story of Dido.

Ticknor saw in the manner in which Dido is represented in this ballad (p. 484 above, Durán, *Romancero,* no. 487) a peculiarly Spanish view (cf. his *History, op. cit.,* Vol. I, p. 145, n.). It represents Aeneas as the aggressor, she desiring to remain faithful to the memory of her first husband. Menéndez y Pelayo (*Antología, op. cit.,* Vol. XII, p. 485) thinks this form is prompted by "la natural simpatía que en todo lector del poema virgiliano despierta la apasionada reina de Cartago, y que de ningún modo puede inspirar su insulso y egoista amante." There was, however, a traditional defense of Dido as well as a widely current condemnation of the "traitor" Aeneas, which was neither peculiarly Spanish, nor the individual and independent conception of the author of this ballad (cf. A. Chassang, *Histoire du roman, etc.,* Paris, 1862, p. 364; *Hertziana,* Munich library, "Antike Sagen," I, no. 27). As Landau has already remarked (*Die Quellen des Dekameron,* p. 290), by the Chroniclers of the Middle Ages the founding of Rome was held to be an incontrovertible fact, and so they readily discovered an anachronism in Aeneas's visit to Dido, a view which possibly had its starting point in Justin's *Universal History,* bk. xviii, chapters 6-8. Cf., however, Paulys *Real-Encyclopädie der Classischen Alterthumswissenschaft,* neue Bearbeitung (Stuttgart, 1905), under "Dido." For an account of the early form of the legend see Friedrich Cauer, *Die Römische Aeneassage von Naevius bis Vergilius,* 15ter Supplementband der Jahrbücher für Classische Philologie; Abdruck (Leipzig, 1886); for the story of Aeneas both independent of Dido and connected with her history, see Dr. E. Wörner, "Programmarbeit des Königlichen Gymnasiums," (Leipzig, 1882), p. 16 ff.: *Die Sage von den Wanderungen des Aeneas bis Dionysios von Halikarnasos und Vergilius.*

Dido was therefore championed at an early date as a much-wronged woman; Virgil's fourth book was considered a poet's creation and took the place of romance. In Italy Petrarch gave voice to this view in his *Trionfi,* IV, Triumphus pudicitiae; cf. *Die Triumphe Francesco Petrarcas,* in kritischem Texte herausgegeben von Carl Appel (Halle a/S., 1901), p. 224, 234:

E [s'io] veggio ad un laccinol Giunone e Dido
Ch' amor pio del suo sposo a morte spinse,
Non quel d' Enea, com' è 'l publico grido,
Non mi debb 'io doler, etc. vs. 10-13.

and again:

Poi vidi, fra le donne pellegrine
Quella que per lo suo diletto e fido
Sposo, non per Enea, volsi ire al fine:
Taccia il vulgo ignorante! io dico Dido,
Cui studio d' onestate a morte spinse,
Non vano amor, come è il publico grido. vs. 154-9.

Dante, as we saw, had put Dido into the inferno. (Cf. also *Lettere di Fr. Petrarca,* note da G. Fracassetti, Firenze, 1864, Vol. II, p. 172, n.) Boccaccio in his *De claris mulieribus* (chapter xl) has told the story of Dido's fidelity to her dead husband as an example of womanly chastity, while he dismisses Aeneas with bare mention. See also *Il Comento di Giovanni Boccaccio sopra la Commedia* con le annotazioni di A. M. Salvini; preceduto dalla vita di Dante Alighieri scritta dal medesimo: per cura di Gaetano Milanesi, Vol. I (Firenze, 1863), comment to verse 61, canto v of *Inferno,* p. 451 ff., the gist of which is: "Vuole l'autore per questa circonscrizione che noi sentiamo, costei essere Didone figliuola che fu del re Belo de Tiro: la istoria della quale si racconta in due maniere." Then follows her history with the discrepancy in time between her epoch and that of Aeneas, with this conclusion: "fu adunque Dido onesta donna," p. 457. This, however, is Boccaccio's view when he writes as a commentator; as a romancer he repeats the story of Virgil; cf. *Laberinto de Amor,* que hizo en toscano el famoso Juan Bocacio: agora nuevamente traduzido en nuestra lengua castellana, año de 1546 [Sevilla], cap. ii: "la reyna Dido . . . vencida del amor de Eneas despues de auerle fecho muchos presentes y fiestas tuuo atreuimiento ella misma de pedirle su amor, etc."; also cap. xxxvi.

In Spain, as early as the *Crónica general,* printed in the 16th century, a full account may be found of both versions. Cf. "Nueva Biblioteca de Autores Españoles," *Primera Crónica general de España* (Tomo I), publicada por Ramón Menéndez Pidal (Madrid, 1906), p. 33, col. 1, chapters 51-60. This is the mediæval version of Dido's history with the usual defense of her character. It is just possible that the very common Spanish sympathy for her was due to her putative share in colonizing Spain (chapter 55), for the

founding of Cartagena was ascribed to her. Carthage and Cartagena were thus fused in the later hostility to Rome, and the Peninsula was naturally leagued with the Carthaginians. In the *Crónica* Dido's story is first given without any reference to Aeneas; then follows the version from the Aeneid closing, just before Dido's death, with a long letter to Aeneas in which she reproaches him for his flight. The letter may be from some old poem based on Ovid's *Heroides*. How great the influence of the *Crónica* was in making the Dido story known is difficult to say. After Boccaccio's *De claris mulieribus*, frequently translated into various European languages (the first Spanish version is *Johan bocacio de las mujeres illustres, en romance*. Çaragoça, 1494; cf. Gallardo, *Ensayo de una Biblioteca, etc.*, Madrid, 1866, Vol. II, col. 97), the lack of connection between her history and that of Aeneas was frequently upheld. In the *Libro de las virtuosas é claras mujeres*, el qual fizo é compuso el condestable Don Alvaro de Luna (first third of the 15th century; cf. Vol. XXVIII of the "Sociedad de Bibliófilos españoles," Madrid, 1891), the author again holds Dido up merely as an example of loyalty and chastity, there being no mention of Aeneas (chapter 35, pp. 229-30); cf. also Juan Rodríguez de la Cámara (ó del Padrón) "Sociedad de Bibliófilos españoles" Vol. XXII: *Triunfo de las donas*, pp. 117, 359. For another defense of Dido see *Curial y Guelfa*, novela catalana del quinzen segle, publicada á despeses y per encarrech de la Real Academia de buenas letras per Antoni Rubió y Lluch (Barcelona, 1901), bk. 3, section 38, p. 394. Jacopo Caviceo, in his *Libro del Peregrino*, etc. (Parma, 1508), uses Dido inconsistently, as his story demanded; she is either a chaste matron: "piu commendata è Didone che Lucretia; l'una per seruar pudicitia con fuoco la uita finì, etc." (edition Vinegia, 1538) p. 52_2, and "l'ammiranda costantia de Dido," p. 191; or she yields to love: "Enea à guisa di trasfuga . . . adimandò il refugio del porto . . . & ella humanissima del porto & del corpo gratia gli fece, etc.," p. 71. These and other citations from the story may imply a rather general acquaintance among readers with the versions of Dido's life.

In the 16th century the epic poet Ercilla thought it worth while to reëstablish Dido's reputation injured by Virgil, *infamandola injusta y falsamente* (*Araucana*, Madrid, 1589, 3d part, canto xxxii, Vol. II, p. 394). So he digressed from his subject to the extent of ninety-eight stanzas, canto xxxii, stanza 45 to canto xxxiii, stanza 55. In the voluminous annotations to his translation of Ovid,

Transformaciones de Ovidio (Valladolid, 1589), el Licenciado Pedro Sanchez Viana treats the subject of Dido's reputation like one much discussed (pp. 240_2, 250_2, ff.); he defends the queen, "una tan casta matrona, como del glorioso sant Hieronymo consta hauer sido Dido." Another translation, *Los quinze libros de los Metamorphoseos, etc.,* by Antonio Perez [Sigler], printed earlier at Salamanca, 1580, was reprinted at Burgos, 1609, "y añadido por el mismo autor un Diccionario Poetico copiosissimo." Now, although Ovid treats Dido and Aeneas after the manner of Virgil (bk. XIV), the writer of the dictionary gives Dido's history independent of Aeneas as the true version, not bestowing on Virgil's hero a single word, p. 468_2. Another defense of Dido and praise of her chastity can be found in the *Tratado en loor de las mugeres y de la castidad, onestidad, etc.,* por Christoval Acosta Affricano (In Venetia, 1592), p. 47. Antonio de Eslava, *Noches de Invierno* (Barcelona, 1609), also speaks of the two different views of Dido's character, p. 176. Agustin de Rojas, *Viaje entretenido,* 1604, in the "exposicion de los nombres historicos y poeticos," appended to the work, gives under Dido, "su verdadera historia, porque la que cuenta Virgilio . . . es falsa y fabulosa"; and Diego Agreda in his *Lugares comunes de letras humanas, etc.,* traduzido de Toscano (Madrid, 1616) under Dido (p. 89) says nothing of Aeneas; cf. also p. 96 on Aeneas. Not to continue indefinitely these references to books of unequal importance and interest—chosen from every field to show the widespread acquaintance with the Dido legend—I shall close with Lope de Vega's censure of Virgil in the prologue to *La Circe* (1624); cf. Rennert, *Life of Lope de Vega,* p. 304, and Lope's *Obras no dramáticas* (Rivadeneyra) "Biblioteca de Autores Españoles," p. 497. Here too Lope blames Virgil for defaming a chaste woman. Thus it becomes evident to what extent Dido's story in the Aeneid was considered romance, and as such proper material to be imitated by novelists.

APPENDIX II.

The comedias of Lope de Vega.

Cf. *Comedias escogidas de Lope de Vega* (Rivadeneyra), 4 vols.; the following are some of the references to Dido, Vol. I: "Matarse quiere.—No hará.—Lo mismo cuentan de Dido. | Matóse encen-

diendo el fuego, | En que se deshizo luego | Por honra de su marido," in *La corona merecida,* p. 245; *Los Telles de Meneses,* I, p. 514; Vol. II: "Fuése á su tierra, ¡ qué milagro! Tambien se fué Eneas de la reina Dido," in *La Dorotea,* p. 4; reminiscences of Dido's lamentation in Dorotea's: "Los antiguos que escribieron ingratitudes de hombres, ¿ qué memoria dejaran de tu crueldad, si fueras de aquel tiempo? . . . ¿ Qué hubieras perdido de quien eres por saber de un cuerpo á quien llevaste el alma, dejándome en estado aquella noche, como no tuve espada para matarme, la hice de una sortija, etc.," p. 37; this indebtedness is strengthened by Dorotea's: "¿ Cómo pienso en esto? Por ventura ¿ imagina que su retrato será la espada de Eneas para la reina Dido?" p. 64; *Servir á buenos:* "No hayas miedo que me queje | De no tener prenda tuya, | Como se quejaba ausente | Elisa Dido de Eneas; | Y cuando no le tuviese, | Espada no ha de faltarme, etc.," p. 433; *La boba para los otros y discreta para sí:* "El Duque, por cubrir, no la flaqueza, | Sino la culpa, sin dejarle espada, | Como Eneas á Dido, fué más necio, etc.," p. 539; Vol. III: *¿ De cuándo acá nos vino?* p. 202; *La fuerza lastimosa:* "viendose engañada | Del duque Vireno, Olimpia, | A voces dice en la playa | A la nave fugitiva: | ¡ Plegue á Dios que te anegues, | Nave enemiga! | Pero no, que me llevas | Dentro la vida," p. 265; but in this there may be some influence of Tasso, *Gerusalemme liberata,* XVI, 40; *El testimonio vengado,* p. 418; *La vengadora de las mugeres:* "Si Dido quiso matarse | Por guardar su castidad | Que no la gozase nadie, | Luego hay un hombre que diga | Que se mató por vengarse | De los agravios de Enéas, | Con quien fué huéspeda fácil," p. 508; Vol. IV: *Adonis y Venus,* p. 426, Dido's loss of her good name.

Miscellaneous references to the Aeneid are very common in Lope, Vol. I; examples are: *Los embustes de Celauro,* the wooden horse, the treachery of Sinon and the destruction of Troy, pp. 91, 108; *La corona merecida:* the conquest of Troy, p. 241; *La Niña de plata:* Helen and the fall of Troy, p. 275; *El perro del hortelano:* the wooden horse, p. 344; *El castigo sin venganza:* Sinon and the wooden horse, p. 576, the conquest of Troy, p. 577; *La noche toledana:* the wanderings of Aeneas, "la sangre de Anquises," p. 206; Vol. II: *La Dorotea,* "huye abrasadas Troyas, etc," p. 29; the birth of Cacus (Aeneid VIII, 193 ff.) p. 38; Nisus and Euryalus, p. 49; beginning of the Aeneid, the wanderings

of Aeneas, p. 49; *El hijo de los leones:* flight of Aeneas from Troy, p. 223; Vol. III: *La Arcadia:* "Caballo de Troya fuí.—Y ella, Elena; Anfriso, Troya," p. 174; *Peribáñez y el Comendador de Ocaña:* "Calla, | que más fuerte era Troya, y la conquista | Derribó sus murallas por el suelo," p. 293; *La vengadora de las mugeres:* capture of Troy, p. 514; Vol. IV: *Roma abrasada:* "¡ Qué de Anquises, que de Eneas | Desda aqui habemos mirado!" p. 299; *El amigo hasta la muerte:* "El que es mitad de mi alma, | . . . El Eurídalo de Niso | . . . El Acates deste Eneas," p. 330; *Mirad á quien alabáis:* Camilla, p. 462; *La inocente Laura:* Sinon and Ulysses, p. 496.

Quotations from Virgil, and praise of his works are common; Vol. I: *El bobo del colegio,* p. 198; *La dama boba.* Virgil among the favorite books of the *bachilleras,* p. 310; Vol. II, *La Dorotea:* Virgil as a standard, p. 45; *same:* "Virgilio llamó á los cisnes roncos, etc., p. 51, *Eneida,* Vol. II, p. 183; p. 52; *Santiago el verde:* not all poets are indigent, "Virgilio tuvo un millon," p. 202; Vol. III: *El guante de Doña Blanca:* Virgil and Octavius, p.. 25; *La Vengadora de las mugeres:* "quisiera ser Virgilio, etc.," p. 518. Other testimony as to Lope's acquaintance with the classics can be found in the Latin quotations in his dedications and prologues.

APPENDIX III.

Some reminiscences of Virgil in "Don Quixote."

Not only in the *Persiles* are there definite reminiscences of the Aeneid. Conventional allusions after the manner of contemporaries, as well as references which indicate Cervantes's particular interest in the story of Aeneas, are quite frequent in his other works. Mention of Aeneas is rather commonplace for those times which dwelt so often on his filial piety; cf. *Don Quixote,* I, 25: "como tambien nos mostró Virgilio en persona de Eneas el valor de un hijo piadoso"; I, 47: "la piedad de Eneas, la valentiá de Aquiles, las desgracias de Hector, las traiciones de Sinón, la amistad de Eurídalo"; II, 3: "no fué tan piadoso Eneas como Virgilio le pinta"; the phrase "todas estas demandas y respuestas revolví en un instante en la imaginación," I, 28, may recall the *Eneida,* Vol. I, p. 139: "Mas la Fenisa Reyna . . . | Revuelve en la turbada fantasia | La gran virtud, y el gran valor de Eneas, etc." (cf. Cor-

tejon's *Don Quixote, op. cit.,* Vol. II, p. 308, n.), but the phrase is not unique with Cervantes. It can be duplicated in the same chapter, and in a form somewhat more like the expression in the Aeneid: "Todas estas cosas revolvía en mi fantasía." The romance of Aeneas and Dido is frequently alluded to. In II, 44 of *Don Quixote,* "en vano sería mi canto si duerme y no despierta para oirle este nuevo Eneas, que ha llegado a mis regiones para dejarme *escarnida*" (cf. Clemencin's *Don Quixote, op. cit.,* Vol. VII, p. 121, n. 45) recalls in the *Eneida,* Vol. I, p. 177: "O Jupiter, que ha de irse este malvado? | Mi Reyno ha de *escarnir* un estrangero?" Altisidora's song, II, 44, parodies Dido's passion: "Dime, valeroso joven, | . . . si te criaste en la Libia | ó en las montañas de Jaca? | Si sierpes te dieron leche?" Cf. *Eneida,* Vol. I, p. 162: "Tú del horrido Caucaso naciste, etc."; Don Quixote's amorous difficulties with the Señora Rodríguez, II, 48: "una estancia más cerrada y secreta que lo que debió de ser la cueva donde el traidor y atrevido Eneas gozó á la hermosa y piadosa Dido," refer to *Eneida,* Vol. I, p. 150: "La Reyna Dido, y el Troyano Eneas, | Entran huyendo en una mesma cueva, etc." In Altisidora's lament, II, 57, the "fugitivo Eneas" recalls the same phrase in the *Eneida,* Vol. I, p. 171. In II, 71, the allusion to Dido's story is more detailed: "en otra [sarga] estaba la historia de Dido y de Eneas, ella sobre una alta torre, etc." Cf. also *Las dos doncellas:* "este segundo engañador Eneas"; *Rinconete y Cortadillo:* "tigre de Ocaña" (Hircania); *Epístola* á Mateo Vazquez: "Y al reino tan antiguo y celebrado, | Ado la hermosa Dido fué vendida | Al querer del troyano desterrado | etc.," edition Hartzenbusch, Vol. VIII, p. 454; Navarrete, (cited also by Cortejón, *op cit.,* Vol. II, p. 79, n.) in speaking of Don Quixote's description of the two great armies, part I, chapter 18, considers it a parallel to Virgil's enumeration of the forces of Turnus, and "not less original"; in II, chapter 41, there is a reference to the wooden horse of Troy.

APPENDIX IV.

Games in the pastoral novels.

It is noteworthy that games or references to sports are especially common in the pastoral novels or in episodes patterned after them. The original suggestion may have come from Virgil's *Georgics,*

II, 527 ff.: "ipse dies agitat festos fususque per herbam, | ignis ubi in medio et socii cratera coronant, | te, libans, Lenaee, vocat, pecorisque magistris | velocis iaculi certamina ponit in ulmo, | corporaque agresti nudant praedura palaestrae"; and III, 19: "cuncta mihi, Alpheum linquens lucosque Molorchi, | cursibus et crudo decernet Graecia caestu." There is also in the Eclogues a spirit of merry-making, where, however, the chief entertainment appears to have been the dance. The enlarged description of sports in Renaissance literature may thus be due to a fusion of the bare spirit of the Eclogues with the episode of book V of the Aeneid. In Montemayor's *Diana,* bk. I, p. 33, "Biblioteca clásica española," we read: "comenzando un día antes de la célebre fiesta á solemnizarla las pastoras y ninfas con cantos é himnos muy suaves, y los pastores con desafíos de correr, saltar, luchar y tirar la barra, poniendo por premio para el que victorioso saliere cuales una guirnalda, etc." In Gil Polo's continuation, bk. V, p. 365 ff., the festivities in which the boats take part may have been influenced by Virgil's boat-race; even more likely is some slight relation between the festival of the boats in the *Persiles* and the episode in Gil Polo: "Vueltos todos hacia allá, y llegandose á la ribera, vieron venir río abajo doce barcas en dos escuadras, pintadas de muchos colores, y muy ricamente aderezadas, etc." Cf. *La Comedia Tibalda* (1553) edited by Bonilla y San Martin, "Bibliotheca hispanica," p. 21: "Pues eres, Tibaldo, dispuesto garzon, | con otros zagales devries procurar | tirar a la barra, correr y saltar | . . . a vezes luchar con otros pastores, etc." In Antonio de lo Frasso's *Diez libros de Fortuna y de Amor* (1573) similar games occur; cf. edit. Londres, 1740, Vol. I, p. 79: "de lexos [Frexano] sintió el ruydo de los regozijados zagales y juegos que entre los pastores hazian, llegó á tiempo de poder ver la corrida de muchos pastores (three prizes) . . . y hecho esto, empezaron mil maneras de juegos, luchar, tirar el canto, tañer varios instrumentos, etc." In the *Galatea* the traditional mention of sports is continued, *Obras de Cervantes* (Rivadeneyra), p. 15: "haciendose todos un corro, dieron lugar á que los zagales vecinos y forasteros se ejercitasen por honra de la fiesta en algunos pastoriles ejercicios . . . dieron principio á mil graciosos juegos, ora tirando la pesada barra, ora mostrando la ligereza de sus sueltos miembros en los desusados saltos, ora descubriendo su crecida fuerza é industriosa maña en las intricadas luchas, ora enseñando

la velocidad de sus pies en las largas carreras, procurando cada uno ser tal en todo, que el primero premio alcanzase; . . . ninguno de cuantos allí estaban . . . llegó al punto que mi Artidoro, etc." The situation of a victorious athlete captivating a maiden resembles the one in the *Persiles*. A more extended description can be found in *Tragedias de amor de gustoso y apacible entretenimiento, etc.,* por el Licenciado Juan Arce Solorzeno (Madrid, 1607), of importance in connection with Cervantes on account of the time of publication; cf. p. 72_2: Y assi [Ergasto] puso premios para los que en los juegos Pancracios se señalassen, que allí eran luchar, correr, saltar, tirar y nadar (with some influence of the Aeneid, bk. V, in the distribution of prizes, and an original variation in the different competitions); 1. luchar, 2. correr, 3. saltar por sobre una cuerda, 4. tirar la ballesta (a pigeon is set free and three shoot simultaneously, the bird being killed by one), 5. tirar una barra, 6. nadar; there are also decorated boats. No influence on Cervantes is apparent. Cf. also Lope de Vega's *Los Pastores de Belén* (1612), in Vol. XVI of "Obras sueltas," edit. Sancha (Madrid, 1778), p. 95: "oirás maravillas . . . de las fiestas, versos, luchas, apuestas, premios y regocijos"; p. 151: "si quisieredes saltar, correr, luchar, y otros iguales ejercicios, á la disposicion de vuestros votos . . . me remito." Cervantes was manifestly fond of painting a hero with athletic skill; cf. *Obras, op. cit.*, p. 111 of *la Gitanilla:* "A do quiera que llegaban, él se llevaba el precio y las apuestas de corredor, y de saltar más que ninguno: jugaba á los bolos y á la pelota extremadamente, tiraba la barra con mucha fuerza y singular destreza, etc."; and p. 114; "en todas las aldeas y lugares que pasaban habia desafios de pelota, de esgrima, de correr, de saltar, de tirar la barra, y de otros ejercicios de fuerza, maña y ligereza, etc." In Italy the funeral games of Virgil were imitated as early as Boccaccio, *La Teseide,* book XI.

APPENDIX V.

The Virgilian games in the Persiles.

A preliminary reference to games in the *Eneida,* Vol. I, p. 114: "Solemnizamos de Accio la ribera | Con los juegos que en Troya ya se usaron: | Y desnudos y ungidos, a manera | Troyana, en lucha algunos se cansaron, | Gozosos de tan prospera carrera, etc." The games of book V follow, p. 189: "Verse ha primero, qual es

mas ligera | De las galeras de la Teucra gente: | Luego, quien vale mas en la carrera: Despues, quien es en lucha mas valiente: | Y cuyo dardo o flecha es mas certera: | Qual con el duro cesto es preminente: | Yo os pondré premios, etc." 1. The place in which the games are held; *Eneida,* I, p. 203: "un hiervoso campo, | (near the sea) Cercado en torno de collados corvos, | *Llenos de espesas selvas y arboledas.* | Estava en medio de un hermoso valle | Un cerco hecho *a modo de teatro,* | Al qual el heroe ilustre, acompañado | De innumerable multitud de gente, | Se vino a proseguir la bella fiesta, | Y en su Real sitial tornó a sentarse."

Persiles, p. 588, col. 1: "Hacíase este espectáculo junto á la marina en una espaciosa playa, á quien quitaban el sol *infinita cantidad de ramos* entretejidos, que la dejaban á la sombra: ponian en la mitad *un suntuoso teatro,* en el cual sentado el Rey y la real familia, miraban los apacibles juegos, etc."

2. Foot-race; *Eneida,* I, p. 203: "Combida luego con preciosas joyas | Los animos de quantos allí estavan | A la carrera, y pide si ay acaso | Quien quiera competir en ligereza, | Y corriendo a la par, mostrar su esfuerzo: | Y poneles delante ricos *premios.* | A la hora, de una parte y otra, acuden | Confusamente Teucros y Sicanos. | Eurialo y Niso acuden los primeros: | Eurialo, de belleza estraña y rara, | *Gallardo joven,* en edad florida. (He wins the prize) . . . Acuden, demás destos, otros muchos." Aeneas then describes the prizes. The race follows, p. 205: "No bien uvo dicho esto, quando todos | Vienen al puesto, y toman sus lugares | *La seña* oida, subito *dejando* | *La cuerda, buelan por el ancho campo,* | Ligeros, qual el viento ligerisimo, | Y echan los ojos juntamente al cabo | De la carrera": . . . p. 206: "Entonce salta Eurialo, y pasa a todos, | Merced del caro y fiel amigo Niso: | Y cierto de victoria y palma, *buela* | Con grande aplauso, grita y vocería | De los que le miravan, y el primero, | Al rojo palio llega victorioso." Aeneas then distributes the prizes.

Persiles, p. 588, col. 2: "cuando ya el teatro estaba ocupado, . . . y cuando ya cuatro corredores, mancebos ágiles y sueltos tenían los pies izquierdos delante y los derechos alzados (strange manner of beginning a race! Cervantes may have had some vase paintings of runners in mind) que no les impedia otra cosa el soltarse á la carrera, sino *soltar una cuerda* que les servia de raya y de señal, que en soltandola *habian de volar* á un termino señalado, donde habian de dar fin a su carrera: digo que en este

tiempo vieron venir por la mar un barco;" . . . it is propelled "de doce, al parecer, *gallardos mancebos, de dilatadas espaldas y pechos, y de nervudos brazos.*" Their leader and the prospective winner is described: "luego la hermosa presencia del mozo arrebató la vista, etc." Policarpo invites the newcomers to take part in the sports: "honrad mis fiestas en lo que quisiéredes, dejadme á mí el cargo de premiároslo, que segun vuestra gallarda presencia muestra, poca esperanza dejáis á ninguno de alcanzar los primeros *premios.* Dobló la rodilla el hermoso mancebo, y inclinó la cabeza en señal de crianza y agradecimiento, y en dos brincos se puso ante la cuerda que detenia á los cuatro lijeros corredores: sus doce compañeros se pusieron á un lado á ser espectadores de la carrera: *sonó una trompeta* (cf. Appendix VI), soltaron la cuerda, y arrojáronse al vuelo los cinco; pero aun no habrian dado veinte pasos, cuando con más de seis se les aventajó el recien venido, y á los treinta ya los llevaba de ventaja más de quince: finalmente, se los dejó á poco más de la mitad del camino como si fueran estatuas inmovibles, etc."

3. *Esgrima* (boxing and fencing): *Eneida,* I, p. 208: "Despues de puesto fin a la corrida, | Dados ya a todos sus preciosos dones, | El padre Eneas dice estas palabras; | Si ay aqui alguno de animo dispuesto | Para mostrar su corazon valiente, | Salga, y a cada mano ate su cesto. | Y *esgrima* con los brazos diestramente | . . . Tal pues como he pintado, el fuerte Dares | La cabeza alta, sale a la batalla. | *Muestra sus anchos y valientes ombros,* | Y a veces ambos brazos esgrimiendo, etc." Entellus is described as "haciendo muestra de sus grandes miembros, | Fornidos huesos, y *nervosos brazos,* etc.," p. 211; when Entellus slips and falls, the spectators "*alzan grita* y clamor que hiere el Cielo," p. 213; the mighty Entellus, however, "con espesos golpes, | Con priesa y con vehemencia a todas manos | Toca, y retoca, bate, y hiere a Dares | Y por el ancho campo le rebuelve," p. 214.

Persiles, p. 589, col. 1: "Fué el segundo certamen el de *la esgrima:* tomó el ganancioso la espada negra, con la cual á seis que le salieron, cada uno de por sí, les cerró las bocas, mosqueó las narices, les selló los ojos, y les santiguó las cabezas, sin que á él le tocasen, como decirse suele, un pelo de la ropa. *Alzó la voz* el pueblo, y de comun consentimiento le dieron el premio primero." Here Cervantes substituted the sword for the less known cestus; the *anchos y valientes ombros,* and the *nervosos brazos* of 3

(*Eneida*) probably suggested the *dilatadas espaldas y pechos y* [*de*] *nervudos brazos* in 2 (Persiles) above; cf. also a similar phrase in the next game.

4. In the next two, *la lucha* and *el tiro de una pesada barra,* Cervantes merely enlarges on sports so frequently mentioned in the pastoral novels, cf. n. 1, p. 508; *Persiles,* p. 589, col. 1: "luego se acomodaron otros seis á la lucha, donde con mayor gallardía dió de sí muestra el mozo; *descubrió sus dilatadas espaldas, sus anchos y fortísimos pechos, y los nervios y músculos de sus fuertes brazos,* con los cuales, y con destreza y maña increible, hizo que las espaldas de los seis luchadores á despecho y pesar suyo quedasen impresas en la tierra; asió luego de una pesada barra . . . la impelió con tanta fuerza, que pasando los límites de la marina, fué menester que el mar se los diese, en el cual bien adentro quedó sepultada la barra." Homer, *Iliad,* XXIII, (cf. p. 507, n. 4) has games of a similar nature, and while Cervantes may have known an Italian version of the Iliad (there was none in Spanish available, cf. p. 479, n. 4) there is no indebtedness to that book of the Iliad apparent. But he probably knew Gonzalo Perez's *Ulyxea,* of which book VIII has some games with incidents not unlike those of the *Persiles;* such as Ulysses's outthrowing all others "que passo las señales de los tiros, | Que antes hauian tirado los Pheaces." But they constitute a parallel rather than an indebtedness and will be treated with the rest of the *Ulyxea* elsewhere. The imitation of Virgil, on the other hand, is most apparent in the next episode.

5. *La contienda de ballesta y flecha; Eneida,* I, p. 216: "luego el padre Eneas | Combidar manda al industrioso juego | De la ligera flecha: y pone premios | A los que en él quisieren competencia. | Manda a una esquadra de soldados que alcen | El mastil de la nave de Sergesto, | Y en lo mas alto dél manda que cuelguen | Atada, de una cuerda, una paloma, | Por blanco de los diestros ballesteros"; p. 217: "Puestos ya en sus lugares por sus suertes | Cada qual tienta con gran fuerza su arco, | Y para el tiro le apercibe y flecha: | Y saca de su aljava su saeta. | La flecha de Hippócoon, con grande estruendo | De la cuerda fortisima impelida, | Hiende las claros ayres la primera, | Y al mastil arribando, en el se fija. | Estremecióse del gran golpe el mastil, | Y reboló la misera paloma, | Medrosa y espantada de la flecha. | El gran clamor y aplauso de la gente | Atronó el mar en torno de la ribera. | Ponese luego a punto el gran Mnesteo, |

Flechando el arco, y hacia la alta seña | Saeta y ojos endereza á una. | No pudo el desgraciado de aquel tiro | Tocar con la saeta a la paloma, | Pero rompió la cuerda y atadura | De lino, en que del alto y grueso mastil, | Estava por los pies atada y presa. | Ella ya libre, hiende apriesa el viento, | Y huye por el ayre y negras nubes. | Al punto Euricion, que ya rato avia | Tenia su flecha y arco apercebido, | Viendo la ave bolar ya alegre y libre, | Y el alto ayre azotar, con prestas alas, | Llamando en su favor al buen hermano, | Flecha con diestra ligereza su arco, | Y allá en una muy alta y negra nube | Traspasa y clava la infeliz paloma. | Cayó al instante muerta: y juntamente | Dió a las estrellas la alma, el cuerpo al suelo: | El qual bajó en la flecha atravesado." The final shot of Virgil, the flaming arrow of strange portent, is naturally omitted in Cervantes.

Persiles, p. 589, col. 1: "pusiéronle luego la ballesta en las manos y algunas flechas, y mostráronle un árbol muy alto y muy liso, al cabo del cual estaba hincada una media lanza, y en ella de un hilo estaba asida una paloma, á la cual habian de tirar no mas de un tiro los que en aquel certamen quisiesen probarse: uno que presumia de certero, se adelantó y tomó la mano, creo yo, pensando derribar la paloma antes que otro: tiró, y clavó la flecha casi en el fin de la lanza, del cual golpe azorada la paloma se levantó en el aire; y luego otro, no menos presumido que el primero, tiró con tan gentil certería, que rompió el hilo donde estaba asida la paloma, que suelta y libre del lazo que la detenía, entregó su libertad al viento, y batió las alas con priesa: pero el ya acostumbrado á ganar los primeros premios disparó su flecha, y como si mandara lo que habia de hacer, y ella tuviera entendimiento para obedecerle, así lo hizo, pues dividiendo el aire con un rasgado y tendido silbo, llegó á la paloma, y le pasó el corazon de parte á parte, quitandole á un mismo punto el vuelo y la vida. Renováronse con esto las voces de los presentes y las alabanzas del extranjero, el cual en la carrera, en la esgrima, en la lucha, en la barra y en el tirar de la ballesta . . . se llevó los primeros premios." The similarity in the language as well as in the sequence of these events will be apparent at once.

APPENDIX VI.

The Boat Race.

Eneas. Vol. I, p. 192: "la trompeta al punto | Sonó, dando señal de un lugar alto | Que a las fiestas se dava ya licencia: |Dióse por suerte la primer conquista | A *quatro naos*, en todas escogidas, | Todas iguales en valientes remos." Then the boats and their captains are mentioned: "Mnesteo govierna a la veloce Pistris, | . . . Iva el buen Gias en la gran Chimera, | . . . la qual impelen . . . los Dardanos mancebos, | Por tres ordenes puestos en los bancos, | Con otras tantas ordenes de remos. | Sergesto . . . Govierna y rige la gran nao Centauro. | Cloantho . . . toma el governalle | De la ligera y verdinegra Scila." The course is described: "Lejos dentro en el mar está un peñasco | A la espumosa orilla puesto en frente; | De las hinchadas olas muy batido, etc." "En esta roca puso el padre Eneas | Un verde pie de una hojosa encina, | Señal desde la qual los marineros | Bolviesen al lugar de do salian. | Luego los *Capitanes*, por sus suertes, | Toman los puestos. Ya en sus naos por orden | *De lejos resplandecen* llenos de oro, | Y con sobervia purpura adornados. | Ya toda la otra juventud Troyana | De alamo blanco, alegre, se corona, | Ya todos muestran *los desnudos ombros* | Resplandecientes con el blando aceyte. | Toma su banco cada qual por orden, | Y asido de su remo, *atentamente* | *Espera la señal con alborozo.* | Un pavoroso sobresalto, junto | Con un vivo deseo de honra y gloria, | Hiere y hace temblar sus corazones. | En el instante mesmo que *la clara* | *Trompeta dió señal* (as in the foot race in *Persiles*), todos a una | Saltan arrebatados de sus puestos. | Los vivos gritos y clamor sonoro | De los remeros, hiere las estrellas. | Tornase blanca espuma toda la agua, etc." The use of a simile: "Jamás cavallos tanto arrebatados | Se arrojaron del puesto a la carrera, | Quando a porfia en el Olimpo campo | Sacan en buelo los ligeros carros," is kept up in the *Persiles;* the race follows: "Alzase en esto *un gran clamor de gente.* | Una alta voceriá, un sordo aplauso, | De los que al espectaculo asistian | A *los competidores* animando. | Resuena todo el bosque, las riberas, | Los huecos montes, y cerrados valles, | Heridos con los gritos y altas voces, | Buelven las mesmas voces y altos gritos. | Salta del puesto Gias el primero, | Entre la mayor grita y alboroto, | Y hiende ligerisimo las ondas; | Salta

empos dél al punto el buen Cloanto, | *En diestros remadores mejorado,* | Sino que la pesada y tarde nave | Contrastava a su fuerza y a su industria. | Tras destos, Pistris y la gran Centauro | Ván en igual distancia compitiendo, | Y entre sí procurando de vencerse." Then follows the humorous event in which the enraged Gias flings his pilot overboard, all of which Cervantes omitted so as not to draw out the race unduly; p. 196: "*Este suceso puso en los postreros* | Mnesteo y Sergesto *alegre confianza* | De pasar y vencer al tardo Gias. | Comienza pues Sergesto a adelantarse | De Mnesteo, y a llegarse apriesa al termino | Bien que por mas que hace, aun no le gana | El largo todo de su nao, mas parte | Va adelantada, y otra parte queda | Igual y en par con la nariz de Pistris. | Pero Mnesteo andando diligente | Por medio de su nao entre sus hombres | Asi los solicita y los anima | . . . Batid, batid los remos presurosos, etc." Then comes the struggle between Mnesteo and Sergesto, p. 198: "Un subito suceso, un caso estraño | Dió del combate la victoria y honra | A aquestos, y a Sergesto la vergüenza. | Fue que Sergesto, loco, y impaciente, | Remetiendo su nao con furia y priesa | Al lado interior ázia la Isla | Juntandose con ella demasiado, | Dió con su nao al traste el miserable, | En la secreta falda de la roca. | Tembló todo el peñon, *los remos fragiles* | De la aspereza dura contrastados, | *Hicieronse en tocando mil pedazos*: | Quedó colgada la cascada proa | En la ladera de la dura peña." His competitor flies forward like a dove; p. 199: "Tal va Mnesteo, y tal su nave Pistris | Va dividiendo el mar cercano a tierra, | Como la impelen su impetu y los remos, |Y dejase primero al buen Sergesto, etc." "Alcanza al punto a Gias, y a la nave | Chimera . . . y atrás la deja . . . Solo a Cloanto tiene ya delante, | Del qual tambien pretende aver victoria: | Siguele con vehemencia y con aliento, | Y ya, ya se le acerca, ya le alcanza. | *Tornase a alzar* aqui *la vocería* | Y alto clamor. Los circunstantes todos | Incitan y dan animo al que sigue, | Resuena el ayre con los vivos gritos. | Los delanteros con vigor vogando, | Muriendo van por conservar la honra | Que hasta alli han ganado, y con la vida | Comprar pretenden la victoria y gloria. | A los que siguen, el suceso prospero | De aver vencido las dos naos, *da aliento,* | Para triunfar tambien de la tercera. | Y ya llevan certeza de poderlo | Solo por parecerles que lo pueden. | Y por ventura *con iguales proas* | Llegaran ambas a tomar los premios, | Si el buen Cloanto, puestas ambas manos | Devoto hacia

el mar, con tal plegaria | Los Dioses no inclinara a su deseo." Cloanto thus wins only by divine intervention.

Persiles, p. 606, col. 1: "Celebróse la fiesta (which is first mentioned p. 604, col. 2), y luego *salieron de entre las barcas del rio cuatro* despalmadas, vistosas por las diversas colores con que venian pintadas, y los remos que eran seis de cada banda . . . luego conocí que querian las barcas correr el palio, que se mostraba puesto en el arbol de otra barca desviada de las cuatro como tres carreras de caballo: . . . El rumor de la gente y el son de los instrumentos era tan grande, que no se dejaba entender lo que mandaba el capitan del mar, que en otra pintada barca venia: apartáronse las enramadas barcas á una y otra parte del rio, dejando un espacio llano en medio, por donde *las cuatro competidoras barcas* volasen sin estorbar la vista á la infinita gente que desde el tálamo y desde ambas riberas estaba atenta á mirarlas: y estando ya los bogadores asidos de las manillas de los remos, *descubiertos los brazos,* donde se parecian los gruesos nervios, las anchas venas y los torcidos músculos, *atendian la señal de la partida, impacientes* por la tardanza, y fogosos, bien ansi como lo suele estar el generoso can de Irlanda, cuando su dueño no le quiere soltar de la traílla á hacer la presa que á la vista se le muestra (note simile). Llegó en fin la señal esperada, y á un mismo tiempo arrancaron todas cuatro barcas, que no por el agua, sino *por el viento parecia que volaban:* una dellas, que llevaba por insignia un vendado Cupido, se adelantó de las demas casi tres cuerpos de la misma barca, cuya ventaja dió esperanza á todos cuantos la miraban de que ella sería la primera que llegase á ganar el deseado premio: otra que venia tras ella iba alentando sus esperanzas, *confiada en el teson durisimo de sus remeros:* pero viendo que la primera en ningun modo desmayaba, estuvieron por soltar los remos sus bogadores: pero son diferentes los fines y acontecimientos de las cosas de aquello que se imagina, porque aunque es ley de los combates y contiendas, que ninguno de los que miran favorezca á ninguna de las partes con señales, con voces ó con otro algun género que parezca que pueda servir de aviso al combatiente, viendo la gente de la ribera que la barca de la insignia de Cupido se aventajaba tanto á las demas, sin mirar á leyes, creyendo que ya la victoria era suya, dijeron á voces muchos: Cupido vence, el Amor es invencible. A cuyas voces, por escuchallas parece que aflojaron un tanto los remeros del Amor.

Aprovechóse desta ocasion la segunda barca, que detras de la del Amor venia, la cual traia por insignia al Interes en figura de un gigante pequeño, pero muy ricamente aderezado, y impelió los remos con tanta fuerza, que llegó á igualarse el Interes con el Amor y arrimándosele á un costado, *le hizo pedazos* todos los remos de la diestra banda, habiendo primero la del Interes recogido los suyos y pasado adelante, dejando burladas las esperanzas de los que primero habian cantado la victoria por el Amor, y volvieron á decir: El Interes vence, el Interes vence. La barca tercera traia por insignia á la Diligencia, en figura de una muger desnuda, llena de alas por todo el cuerpo, que á traer trompeta en las manos, antes pareciera Fama que Diligencia: viendo *el buen suceso* del Interes, *alentó su confianza,* y sus remeros se esforzaron de modo que llegaron á *igualar* con el Interes; pero por *el mal gobierno del timonero* se embarazó con las dos barcas primeras de modo que los unos ni los otros remos fueron de provecho. Viendo lo cual la postrera, que traia por insignia á la buena Fortuna, cuando estaba desmayada y casi para dejar la empresa, viendo el intricado enredo de las demas barcas, desviándose algun tanto dellas por no caer en el mismo embarazo, apretó, como decirse suele, los puños, y deslizándose por un lado pasó delante de todas. Cambiáronse los gritos de los que miraban, cuyas voces sirvieron de aliento á sus bogadores, que embebidos en el gusto *de verse mejorados* les parecia que si los que quedaban atras entonces, les llevaran la misma ventaja no dudaran de alcanzarlos ni de ganar el premio, como lo ganaron, más por ventura que por lijereza. En fin, la buena Fortuna fué la que la tuvo buena entonces, etc."

The account of this race in the majority of its details, at least, sounds sufficiently factitious to justify the belief that Cervantes, far from knowing anything of such races at first hand, merely rewrote Virgil with judicious changes and omissions. In both events the boat which starts off most promisingly is defeated; in each a boat is put out of the race by the same kind of misfortune (broken oars), and in each case the victory comes as a surprise to the spectators. The introduction of a simile is due to Virgil's manner (cf. el can de Irlanda), while phrases like (*Eneida,* p. 198): "Y pidiendo favor al diestro viento, | Pasa volando por el mar," and (p. 200): "Ella mas presta que el veloce Noto, | . . . huye á tierra," may have suggested, (*Persiles,* p. 606): "por el viento parecia que volaban;" just so (*Eneida,* p. 192): "govierna

con fuerza de briosisimos remeros" is not unlike (*Persiles*, 606): "iba . . . confiada en el teson durisimo de sus remeros." The *mal gobierno del timonero* of the *Persiles* also recalls the *indiscreto y tardo de Menetes*, the bad pilot who spoiled the chances of Gias. It is also possible that a phrase at the beginning of this same book of the Aeneid: "Y pues *Fortuna* vence, es bien seguillos (vientos)" *Eneida*, p. 186, may have suggested the name of the victorious boat in the *Persiles*. The four boats of Virgil are called *Pistris, Chimera, Centauro* and *Scila;* in book X the decorations or emblems of some of Aeneas's boats are described: one (Vol. II, p. 108) has "los Leones de Troya" painted on the prow; another "un rutilante Apolo; the Centauro "lleva un centauro altisimo pintado" on the prow; another a Triton with a shell, half man (hombre velloso) and half monster. Cervantes also decorates his boats in the *Persiles;* one of them bears the figure of a little giant, one has a little Cupid, and another a nude woman with many wings (alas) all over her body. Cf. p. 548.

APPENDIX VII.

The machinery of adventure in the Aeneid and the Persiles.

The following parallels are to show how the epic manner as well as the machinery of adventure, *peregrinaciones*, in the Aeneid resembles that of the *Persiles*, though there may be no indebtedness to the former on the part of the latter.

1. The first books of the Aeneid are filled with the spirit of the wanderings which characterize the earlier half of the *Persiles*. *Eneida*, I, p. 2: "por qué causa | La Reyna de los Dioses enojada, | Forzó al varon asi en piedad insigne | A sufrir tantos y tan *duros casos*, | Y a padecer *trabajos* tan immensos?" p. 6: "Esparcelos a partes diferentes, | A varias tierras, a diversas gentes." p. 15: "la memoria de aquestos *duros trances*" and "Por varios casos, por fragoso y duro | Camino, a la famosa Italia vamos"; p. 23: "Por gentes y lugares ignorados, | Por tierra y mar, peregrinando andamos"; p. 96: "Sabe que has de ir mil tierras *peregrino*, | Gran trecho has de pasar del mar insano. | Llevarte ha en fin a Italia tu destino"; p. 106: "Mil estrechuras de agua navegamos | *Entre Isla y Isla* con furor movidas"; p. 109: "do no podia verse tierra entramos, | Mas solo a todas partes mar y Cielo"; p. 113: "No penseis que aveis antes de veros | En *la Ciudad que dada os tiene*

el hado; and: "guardadlos de casos lamentables"; p. 119: "Suplicote me seas norte y guia | Para escaparme de peligros tales: | . . . Para evitar trabajos tan mortales"; and "Tu has de ir por muchos mares peregrino, | Que Jupiter lo ordena y *tu destino.*" For similar ideas see pp. 26, 35, 98, 117, 225, 285.

Persiles, p. 565, col. 2: "este en que nos hallamos ha de ser el último *trance* que de nuestras desventuras pueden temerse"; p. 568, col. 1: "halléme solo en la mitad de la inmensidad de aquellas aguas, sin tomar otro camino que aquel que le concedia el no contrastar contra las olas ni contra el viento"; and: "no sé á cabo de cuantos dias y noches que anduve vagabundo por el mar, . . . me vine a hallar junto á una isla despoblada"; and col. 2; p. 576, col. 1: "Están todos aquellos mares casi *cubiertos de islas* . . . y . . . deseaban topar alguna que los acogiese"; p. 581, col. 2: "vamos *llevados del destino* y de la eleccion á la *santa ciudad* de Roma"; p. 585, col. 2: "vieronse en mar no conocida, amenazados de todas las inclemencias del cielo"; and: "con el [dia] descubrieron por todas partes el mar cerca y lejos"; p. 588, col. 1: "Desta manera anduvieron casi tres meses por el mar de unas partes á otras; ya tocaban *en una isla, ya en otra;* y ya se salian al mar descubierto"; p. 598, col. 2: "andante peregrino," the latter word being very common; p. 613, col. 2: "nos hallamos en la ribera de una isla no conocida." Mention of a single island is very common; cf. p. 588, col. 1, 604, col. 1, "las riberas de una isla," 621, col. 2, "aquella isla . . . Escinta," which recall such passages in the *Eneida,* I, p. 12: "Ay un lugar . . . en el qual una isla, etc."; p. 137: "Está en el mar Sicanio una isla"; p. 614, col. 1: "trabajos y peregrinaciones." The fact that Italy and Rome are the goal of both wanderings is presumably a coincidence.

In the *Galatea* there is a similar passage: p. 68, col. 1: "discurrimos por todas las islas de aquel derecho;" even the "antiguas ruinas de Cartago" are seen.

2. Night and storm are the common experiences; *Eneida,* I, p. 7: "Comienza en esto un gran clamor de gente | Y un espantoso rechinar de cuerdas: | En un instante *las escuras nubes* | Cubren la luz y el Cielo a los Troyanos. | *Una cerrada y tenebrosa noche* | Tiende sobre el turbado mar sus alas: | Rebrama el Cielo del un Polo al otro | Con gran frequencia de espantosos *truenos:* | Mostrando con *relampagos espesos* | Su resplandor fogoso y luz

ardiente. | Mar, Cielo, y viento, y todo el Universo, | *Amenaza con cierta y presta muerte* | A los Troyanos tristes y afligidos"; *"una gran borrasca* | *Que vino* retronando de azia el Norte | Hiere la vela con vehemencia horrible, | Y sube al Cielo las bravosas olas: | Hacese cada remo mil pedazos. | Trastornase la proa, y pone el lado | De la nao a la furia de las ondas; | Alzase en esto de agua un alto monte, | Y enviste en ella con furioso golpe. | *Penden algunos en las altas olas,* | Y en el hinchado mar andan subidos. | *A otros la agua* del mar hondo abierta | Les *muestra* por entre ola y ola *el suelo.* | *Hierve la arena* y la agua, etc."

Persiles, p. 590, col. 2: "enmarañándose *las nubes, cerró la noche escura y tenebrosa,* y los *truenos* dando por *mensajeros á los relámpagos,* tras quien se siguen, comenzaron á turbar los marineros, y á deslumbrar la vista de todos los de la nave, y comenzó la *borrasca* con tanta furia, que no pudo ser prevenida, etc."; "se excusaron de no verse unas veces tocar el cielo con las manos, *levantandose el navío* sobre las mismas nubes, y otras veces *barrer la gavia las arenas* del mar profundo: *esperaban la muerte* cerrados los ojos, etc."; "Atrevióse el mar insolente á pasearse por cima de la cubierta del navío, y aun á visitar las mas altas gavias, etc."

3. Episodes of landing or embarking. *a. Eneida,* I, p. 13: "Dejan las naos con ligereza presta, | Y gozan de la arena deseada: | . . . Hiere el fogoso pedernal Acates, | Y hace saltar dél centellas vivas: | . . . Asió en la yesca el fuego, etc."; p. 103: "Aquesta isla amenisima dió aliento | A los que el mar traia quebrantados"; p. 242: Another landing and striking fire from flint. *b.* They come upon a little town; p. 114: "En este puerto entramos fatigados, | Y la ancora de proa al suelo echada, | Alli quedaron los navios clavados: | Y una ciudad pequeña nos dió entrada." *c.* The ruler himself comes out to meet the wanderers; p. 187: "El Rey Acestes, que de la alta cumbre | De un alto monte avia de lejos visto | Llegar alli las naos de sus amigos, | Maravillado, sale a recibirlos; and p. 309: "Corre delante un mensajero al punto, | Espoleando un corredor cavallo, | A dar aviso al grave Rey Latino | De como a su Ciudad avian llegado | Ciertos varones de valientes cuerpos, | En habito estrangero y peregrino. | El Rey manda llamarlos a su casa, etc." *d.* The Trojans come upon a lost wanderer (a Greek); p. 132: "pidoos, nos venia diciendo, |

Por los a quien da el Cielo eterno estrado, | Por las estrellas . . . | Que me saqueis de aqui, etc."

Persiles, a. p. 574, col. 1: " llegaron á una isla . . . saltaron todos en tierra, en la cual vararon las barcas, y con gran priesa se dieron á desgajar árboles, y hacer una gruesa barraca . . .: hicieron asimismo fuego, ludiendo dos secos palos, el uno con el otro, etc." Cervantes uses a different method of creating fire, possibly to conform with what he considered northern customs. *b.* They are carried into a harbor with a town; p. 591, col. 2: "los piadosos cielos . . . ordenaron que la nave fuese llevada poco á poco . . . á la orilla del mar en una playa, . . . y no lejos estaba un puerto . . . en cuyas aguas, como en espejos claros, se estaba mirando una ciudad populosa, etc." *c.* The King comes out to meet the strangers; p. 591, col. 2: "salió infinita gente á verlo (the ship), y certificándose ser navío lo dijeron al rey Policarpo, que era el señor de aquella ciudad, el cual acompañado de muchos . . . salió tambien, etc."; p. 618, col. 1.: "vimos [la ribera] coronada de infinito número de gente . . . Venia entre ellos sobre un hermoso caballo el rey Cratilo, etc." *d.* The pilgrims find an Italian wrecked among the man-eating savages of the north as the Greek had been among the Cyclopes; p. 571, col. 1: "llegó á la orilla del mar un bárbaro gallardo, que á grandes voces en lengua toscana dijo: Si por ventura sois cristianos los que vais en esas barcas, recoged á este que lo es, y por el verdadero Dios lo suplica." In this connection the phrases "luego alzaron | Con alborozo alegre voceria" (*Eneida,* I, p. 104, said of the Trojans who are told of the promised land for which they are about to set out) and "alzando una alegre voceria" (*Persiles,* p. 618, col. 1, said of some northern natives who draw the wanderers ashore) are of interest. Cervantes was fond of using it; p. 571, col. 1: "alzaron las voces con alegres acentos" on reëmbarking.

4. After the wanderers have landed, they generally hasten to prepare a meal, and repose from their hardships; or they may be invited to eat with their hosts; *Eneida,* Vol. I, p. 15: "Ponen otros las ollas y calderas | En la ribera, y danles fuego apriesa. | Tiendense por la fresca y verde yerva, | Y recobran las fuerzas con manjares, etc."; Dido has invited the Trojans to a feast, whereupon the narrative continues, p. 47: "Luego que se acabó el real vanquete, | Y alzaron los manteles de las mesas, | Ponen en ellas

tazas, etc." Then Dido pours a libation to the gods, which is followed by Aeneas's narrative; again, p. 305: "Aderezan al punto la comida | . . . Ponen las carnes y silvestres frutas." Vol. II, p. 13: "Ya que a la hambre uvieron satisfecho, | Y el guloso apetito reprimido, | Comienza asi a decir el Rey Evandro."

Persiles, p. 574, col. 1: "llegaron á una isla tambien despoblada, aunque no de árboles, porque tenia muchos y llenos de fruto, que aunque pasado de sazon y seco, se dejaba comer." They go ashore, gather wood for a hut and for fire: "Satisfacieron la hambre," whereupon a story follows; p. 577, col. 1: "acudieron á sus naves algunos, y con tanta priesa como buena voluntad, trajeron della los regalos que tenian; hízose lumbre, pusiéronse las mesas, y . . . satisfacieron todos la hambre, etc.," Mauricio then tells his story; p. 617, col. 1: "mandó echar el esquife al agua, y que saliesen todos á tierra á pasar la noche en sosiego, libres de los vaivenes del mar . . . . A la sombra de una peña los de la tierra se repararon del viento, y á la claridad de mucha lumbre . . . se defendieron del frio"; and p. 618, col. 2, the wanderers receive food and shelter from the inhabitants of the island.

5. Episodes of departure, leave-taking, separation and the like, which are characteristic of stories of adventure; *Eneida,* Vol. I, p. 124: "En tanto Anchises caminar queriendo, | Las velas al buen viento alzar mandava, etc."; p. 126: "En esto yo con ojos lacrimosos | Partiendo de los huespedes amados, | Quedaos, les dige, a Dios, vivid dichosos | Los que estais de fortuna descuidados; | Nosotros por los hados rigurosos | Somos de un mal en otro mal llevados; | Vosotros ya teneis quieto asiento, | Ni temeis bravo mar, ni adverso viento." p. 234: "En tanto ya los agradables vientos | El mar avian compuesto y allanado, | Ya el Austro con continuo y cierto soplo | Las naves otra vez llamava a la agua. | Llegada la sazon ya de partirse, | Levantase un confuso y triste llanto | Por la hueca ribera, y abrazados | Los unos de los otros, sin poderse | Partir, se están un dia y una noche."

Persiles, p. 623, col. 2: "Dos dias tardaron en disponerse y acomodarse para seguir cada uno su viaje, . . . andaba Rutilio de unos en otros, . . . despidiéndose destos y de aquellos, mezclando sollozos y lágrimas todo á un tiempo; finalmente, convidándoles el sosegado tiempo y un viento que podia servir á diferentes viajes, se embarcaron y le dieron las velas, etc."; p. 641, col. 2: "Algunos dias se pasaron poniendo en orden

su partida para Roma . . .: llegóse el dia de la partida, donde hubo tiernas lágrimas y apretados abrazos y dolientes suspiros, etc."

A common incident is that of the chance separation of hero and heroine, or of the wanderers in general. In the classic epics, however, there was a genuine tragic note in such episodes, as for example in the separation of Hector and Andromache, or of Aeneas and Creusa. The pathos of these events was of influence on the earliest romances, but in the story of adventure not only the protagonists, but groups of wanderers are sure to meet again, no matter how often they are separated. This was a part of the machinery of adventure to which the Aeneid contributed. *Eneida,* Vol. I, p. 93: "A Creusa perdi, mi dulce abrigo: | O que el hado cruel le echase mano, | O que el camino errase, o que cansada | Quedase, ay triste, a descansar sentada; | No la vi mas, etc." Aeneas searches for her everywhere: "Llevava firme intento de bolverme | A renovar mi acerba y dura suerte, | Y en los peligros otra vez meterme, etc." "Mil veces a Creusa llamé en vano." Aeneas is also separated from some of his companions during his peregrinations (bk. I).

Persiles, p. 562, col. 2: "Andando mi Señora Auristela por la ribera del mar, solazándose, . . . llegaron unos bajeles de cosarios, y la robaron, etc."; p. 585, col. 1: "Llegóse en esto la noche, sin que la barca pudiese alcanzar al esquife, desde el cual daba voces Auristela, llamando á su hermano Periandro, que la respondia . . . Transila y Ladislao hacian lo mismo, y encontrábanse en los aires las voces de dulcísimo esposo mio y amada esposa mia, etc." On p. 608, Auristela is again carried off and Periandro sets out in pursuit.

Chance meetings and reunions are characteristic. At the close of book I of the Aeneid, Aeneas again meets some of his stranded companions whom a storm had carried off. In book III he finds compatriots, Helenus, Andromache and others, in the course of his peregrinations. In the *Persiles* these incidents are of frequent occurrence. On p. 577, col. 1, Mauricio finds his daughter, Transila; on p. 580, col. 2, Periandro and his group again meet Arnaldo and his party; hero and heroine are separated and meet again quite often; p. 565, col. 2: "suerte dichosa ha sido el hallarte, etc."; also 592, col. 1.

6. Lamentations, longing for death, complaints of hardships, cruel fate, slavery and the like occur often in the story of adventure. Cf. *Eneida,* I, p. 54: "Qué tierra avra que ya tragarme pueda? | Qué mar que quiera, ay triste, ya sorverme? | Ya qué refugio, ay misero, me queda, | Do pueda en mis desastres acogerme?" p. 116: "Confusa, y encogida, responde esto. | O sola mas que todas fortunada, | Polixena, que de una ya acabaste, | . . . Y no fue sobre ti la suerte echada, | De captividad dura te escapaste. | . . . Yo sin ventura, . . . por mil mares y tierras me llevaron: etc." Heroines show their grief in the same way; p. 177: "[Dido] Hirió su tierno y muy hermoso pecho | Con mano ayrada tres y quatro veces, | Apedazó el cabello de oro puro, etc."; p. 180: "Oy es mi triste postrimero dia, | Ya el curso de mi vida es acabado, etc."

Persiles, p. 561, col. 1: "Gracias os hago, o inmensos y piadosos cielos, de que me habeis traido á morir adonde vuestra luz vea mi muerte, . . . bien querria yo no morir desesperado . . . pero mis desdichas son tales, que me llaman, y casi fuerzan á desearlo"; p. 562, col. 1: "En triste y menguado signo mis padres me engendraron, y en no benigna estrella mi madre me arrojó á la luz del mundo; . . . libre pensé yo que gozara de la luz del sol en esta vida; pero engañóme mi pensamiento, pues me veo á pique de ser vendida por esclava"; p. 565, col. 2: "como creo que este en que nos hallamos, ha de ser el último trance que de nuestras desventuras puede temerse, suerte dichosa ha sído el hallarte, etc."; p. 574, col. 1: "Al cielo y á vosotros . . . agradezco esta mudanza y esta mejora de navío: aunque creo que con mucha brevedad le dejaré libre de la carga de mi cuerpo, porque las penas que siento en el alma me van dando señales de que tengo la vida en sus últimos términos"; p. 587, col. 1: "Ay, dijo á esta sazon, con que prodigiosas señales me va mostrando el cielo mi desventura, que si se rematara con acabarse mi vida, pudiera llamarla dichosa, etc."; p. 651, col. 1: "Ay de mi, otra vez sola y en tierra ajena, etc." Elsewhere Cervantes's heroines tear their hair; cf. *Obras, op. cit.,* p. 201, col. 1, p. 204, col. 2; also previous article, appendix, p. 24.

7. In these strange peregrinations the wanderers are generally ignorant of their whereabouts; they ask for information; *Eneida,* Vol. I, p. 23: Aeneas addresses his mother, "Suplicote nos sean por ti aliviados | Estos duros trabajos que pasamos: | Danos

noticia, y haznos avisados | De en qual region, provincia, o clima estamos. | Por gentes y lugares ignorados, | Por tierra y mar, peregrinando andamos, etc." "Responde Venus . . . Los Reynos Africanos vees en frente, etc." In the *Persiles* the travelers generally have a very vague idea of where they are; p. 572, col. 2: "oí que venia hablando por junto de donde estaba, alguna gente, y así fué verdad, y saliendoles al encuentro, les pregunté en mi lengua toscana, que me dijesen qué tierra era aquella; y uno dellos asimismo en italiano me respondió: Esta tierra es Noruega, pero, quién eres tú? etc."

As in Heliodorus, a stranger excites general curiosity; *Eneida,* Vol. I, p. 25: "os pido | Que me sea de alguno declarado, | Quién sois? á qué venís? de qué regiones | Salistes? etc."; p. 41, Dido asks: "Hijo de Venus, qual destino triste | Te ha por tantos peligros perseguido? | Por qué violencia o caso ser pudiste | A aquesta region barbara traido?"; p. 117, Andromache has told Aeneas her misfortune: "Mas dime ya, quál Dios, quál hado, o viento, | Tan sin pensar aqui te ha oy traido? | De Ascanio, qué es? etc."; p. 132, the lost Greek is questioned: "De su linaje y tierra fue rogado | Que, sin nos engañar, nos informase, | Por qué suceso uviese alli arribado." Vol. II, p. 8: "Decid, hombres, qué causa os ha forzado | A tentar los caminos no sabidos? | Do va vuestro viaje enderezado? | De qué linaje sois? y do nacidos? | De do salistes? etc."

Persiles, p. 562, col. 1: "luego le comenzó [á Arnaldo] á fatigar el deseo de saber dél [de Periandro] lo más presto que pudiese, quién era, cómo se llamaba, y de qué causas habia nacido el efecto que en tanta estrecheza le habia puesto"; or p. 574, col. 1: "acomodáranse á dormir luego, si el deseo que Periandro tenia de saber el suceso del músico no lo estorbara, porque le rogó si era posible les hiciese sabidores de sus desgracias, pues no podian ser venturas las que en aquellas partes le habian traido"; cf. also preceding article, p. 23.

In the answers to such questioning, the manner of the classical epic is much like that of the romance of adventure. 'I cannot recount my hardships to you from the very beginning.' *Eneida,* Vol. I, p. 26: "Si *del principio,* o Diosa, te contase | La triste y desastrada suerte mia: | Y si escuchar la historia te vagase | Del trabajo sufrido hasta oy dia | Sé cierto que primero que acabase, | La tenebrosa sombra cubriria | El cielo a todas partes,

etc." In the *Persiles*, the hero is urged to tell his experiences, p. 604, col. 1: "A lo que Periandro respondió, que sí haria, si se le permitiese comenzar el cuento de su historia, *no del mismo principio*, porque este no le podia decir ni descubrir á nadie, etc." The hero though urged to begin at the beginning, really launches himself *in medias res*. *Eneida*, Vol. I, p. 49: "Huesped, será a mi ver mas acertado | Que del principio el Griego engaño digas: | Lo que has por tierra y mar peregrinado, etc." Aeneas begins with the tenth year of the Trojan war. In the *Persiles*, p. 604, col. 1, Periandro says: "El principio y preámbulo de mi historia . . . quiero que sea este: que nos contempleis á mi hermana y á mí, con una anciana ama suya embarcados en una nave, etc."

8. From the pictorial history of the Trojan war which Aeneas sees at Carthage, he learns how widely known his story is; *Eneida*, Vol. I, p. 31: "Qué tierra o qué region del ancho suelo | No ha ya entendido nuestra desventura, etc." The appearance and the experiences of the protagonists of the *Persiles* are known in Portugal, Spain, France and Italy, p. 672, col. 1, and a playwright even plans a *comedia* "de los sucesos de Periandro y Auristela, que los sabia de memoria por un lienzo que habia visto en Portugal," namely their pictorial history treated above.

9. *a*. The use of certain words and phrases in both the *Eneida* and the *Persiles* is worth noting. The number *three* in connection with events or actions is common in the classic epics (cf. Homer's *Iliad*, bks. XXII, v. 165, XXIII, v. 817); *Eneida*, Vol. I, p. 33: "Tres veces parecia el fiero Achiles, etc."; p. 96: "Por tres veces los brazos alargando | De le enlazar el cuello tuve intento, etc."; p. 130: "Tres veces resonó un horrible estruendo"; p. 134: "Por tres veces ha ya la Luna nueva | A redondez sus cuernos reducido"; p. 183: "Tres veces, con las vascas de la muerte, | Sobre el codo estrivando, *provó a alzarse*, | *Mas otras tantas tornó a dar consigo* | Sobre la cama un lastimoso golpe"; also pp. 256, 285, 307, Vol. II, pp. 37, 141, 167. Cf. the *Persiles*, p. 562, col. 1: "Y en esto probó á levantarse para ir á besarle los pies, mas la flaqueza no se lo permitió, porque tres veces lo probó, y otras tantas volvió á dar consigo en el suelo." *Galatea*, p. 83, col. 1: "Tres veces rodeó Telesio la sepultura, y tres veces dijo las piadosas plegarias, etc."; in this connection cf. Sannazaro, *Arcadia*, edition of Scherillo, *op. cit.*, p. 213 and note; *Don Quixote*, I, chapter 26, p. 318, col. 2: "Tornóla á decir otras tres veces, y otras tantas

volvió á decir otros tres mil disparates." Cf. also, I, chapter 20, Clemencin's edition, *op. cit.*, Vol. II, p. 148, n. 56, where Clemencin sees some connection between "cuatro veces sosegó, etc.," and Virgil's "bis conatus erat, etc.," Aeneid, VI, 32; the connection is more probable in *Don Quixote*, II, chapter 58: "dos veces repitió estas mismas razones, etc.," *Obras*, p. 527, col. 2; cf. also Eclogue V, vs. 65 ff. Torraca, *Materia dell' Arcadia, etc.*, p. 63 speaks of this mannerism. The number *seven* has also a peculiar use: Aeneid, V, 85, VI, 21.

The phrase, *Eneida*, Vol. I, 162: "Tú del horrido Caucaso naciste, | El te dío esa alma dura y peñascosa," has been touched upon, p. 504, n. 2, and in Appendix III. Compare in the *Persiles*, p. 602, col. 1: "habiendote criado . . . entre riscos y peñas de las cuales has sacado tambien la dureza de las entrañas"; p. 578, col. 2: "la codicia humana que reina y tiene su señorío aun entre las peñas y riscos del mar y en los corazones duros y campestres, se entró aquella noche en los pechos de aquellos rústicos pescadores, etc."; and p. 587, col. 2: "qué quiere este que llaman amor por estas montañas, por estas soledades y riscos, etc." These sentiments are more common in the pastoral novels and so recall Eclogue VIII of Virgil, vs. 43 ff., which Luis de Leon translates: "Ya te conozco, Amor; entre las breñas, | En fiero punto, en dia temeroso, | Ni nuestro en sangre, ni con nuestras señas, | De duras Garamantas, del fragoso | Rodope procediste, y de las peñas | Del Ismaro, que bate el mar furioso."

In the *Eneida*, Vol. I, p. 180, the "dulces exuviae dum fata deusque sinebat" (bk. IV, v. 651), is rendered: "O dulces prendas, quando Dios queria, | Y me era amigo mi infelice hado"; Gregorio Hernández may have had Garcilaso in mind, whose well-known sonnet was frequently quoted: "O dulces prendas por mi mal halladas, | Dulces y alegres cuando Dios queria!" Cervantes uses the phrase twice in the Persiles; p. 565, col. 2: "oh prenda, que no sé si diga por mi bien ó por mi mal hallada, etc."; p. 614, col. 2: "oh ricas prendas por mi bien halladas, dulces y alegres en este y en otro cualquier tiempo!" Cf. also *Don Quixote*, II, chapter 18, in which the verses by Garcilaso are quoted, and I, chapter 25, p. 314, col. 2: "[al rucio] no le tocaban las generales de enamorado ni de desesperado; pues no lo estaba su amo, que era yo *cuando Dios queria*," (noted by Clemencin), but already in the *comedia de Calisto y Melibea*, XII, near the end, may be found:

"y aun assi me trataba ella *quando Dios queria.*" In *La guarda cuidadosa* by Cervantes, edition of Hartzenbusch, Vol. XII, p. 216, the phrase "tan dulces prendas, por mi mal halladas," occurs; also in Lope's *El Bastardo Mudarra,* act II, toward the close, the verse is used as a kind of refrain.

"Vox faucibus haesit," Aeneid, III, 48, IV, 280, XII, 868, is rendered in *Eneida,* Vol. I, p. 101: "La voz a la garganta quedó asida"; p. 157: "Pegósele la voz a la garganta"; Vol. II, p. 262, the same; cf. in the *Persiles,* p. 563, col. 1: "se le atravesó un ñudo en la garganta"; p. 574, col. 2: "añudóseme la voz á la garganta y pegóseme al paladar la lengua"; p. 595, col. 2: "se le añudó la garganta y se le trabó la lengua"; *Don Quixote,* I, chapter 27: "un ñudo se le atravesó en la garganta" (Clemencin, Vol. III, p. 21); II, chapter 39: "pegóseme la voz á la garganta," is identical with the *Eneida.*

The manner of the *Eneida,* Vol. I, p. 94: "renovar mi acerba y dura suerte" and p. 109: "Renovóme fortuna el viejo duelo" is recalled by the *Persiles,* p. 621, col. 1: "renováronse mis trabajos."

In the *libro tredecimo* de Mapheo Veggio, *supplemento de la Eneida,* Vol. II, p. 279, these lines occur: "Todo lo que al pasar les fue enojoso, | Al recordarlo es dulce y agradable." This exists in the editions as early as 1577. Cf. in the *Persiles,* p. 617, col. 1: "Si es verdad, como lo es, ser dulcísima cosa contar en tranquilidad la tormenta, y en paz presente los peligros de la pasada guerra, y en la salud la enfermedad padecida, dulce me ha de ser á mí agora contar mis trabajos en este sosiego." And. p. 619, col. 1: "Cuando los trabajos pasados se cuentan en prosperidades presentes, suele ser mayor el gusto que se recibe en contarlos, que fué el pesar que se recibió en sufrirlos." The contrary fortune is expressed in Dante's: "Nessun maggior dolore, | Che ricordarsi del tempo felice | Nella miseria."

Compare also the following descriptions of a shooting episode; *Eneida,* Vol. II, p. 207, (bk. XI): "Y puesta [la saeta] en el corvo arco, con gran furia | Comienza a le flechar, y flechó tanto | Que se juntavan ya las empulgueras: | Y por igual las manos apartadas, | La siniestra tocó el casquillo agudo: | La diestra con la cuerda tocó el pecho. | Subito Arunte . . . della se halló pasado el pecho." In bk. X, *Eneida,* Vol. II, p. 118, Pharo is shot in the mouth and killed.

Persiles, p. 565, col. 2: "el bárbaro . . . puso una grande y aguda flecha en el arco, y desviándole de sí cuanto pudo extenderse el brazo izquierdo, puso la empulguera con el derecho junto al diestro oido, y disparó la flecha con tan buen tino y con tanta furia, que en un instante llegó á la boca de Bradamiro y se la cerró, etc."

In the *Eneida,* Vol. II, p. 230, a death is described: "cierrale luego al triste . . . un reposo mortal los frios ojos: | Y en una eterna noche los sepulta." *Persiles,* p. 566, col. 1: "Cerró el capitán en sempiterna noche los ojos."

b. In *Don Quixote* an occasional phrase recalls Virgil and may have grown out of the classical manner, though indirectly. The *Eneida,* for example, has, Vol. I, p. 64: "Con gran clamor y horrisono gemido | *Heria el ayre* y Cielo"; p. 71: "do suena el clamor que el Cielo hiere"; p. 194: "Los huecos montes, y cerrados valles, | Heridos con los gritos y altas voces, etc."; p. 213: "grita y clamor que hiere el Cielo." This represents the original "clamores simul horrendos ad sidera tollit," II, 222; "sublatus ad aethera clamor," II, 338; "ferit aethera clamor," V, 140; "tollitur in caelum clamor," XI, 745. Cervantes has: *"hirio el aire* con semejantes palabras," p. 527, col. 2, of II, chapter 58, which in no case is like the original Latin, but like the *Eneida.*

Clemencin (n. 75 to I, chapter 27 of *Don Quixote*) compares: "á los cuales [desdichados] suele ser consuelo la imposibilidad de tenerle," and "que en los males sin remedio, el mejor era no esperarles ninguno," *Galatea,* I, with "una salus victis nullam sperare salutem" II, 354 of the Aeneid; cf. *Eneida,* Vol. I, p. 72: "Solo les queda a los vencidos una | Salud, que es no esperar salud alguna." With regard to another phrase in *Don Quixote:* "si ya le oistes nombrar en algún tiempo," I, chapter 47, Clemencin compares Aeneid, I, 375-6: " si vestras forte per aures | Troiae nomen iit"; *Eneida,* Vol. I, p. 26: "si Troya acaso aveis jamás oido"; cf. also *Don Quixote,* II, chapter 58; "si es que ha llegado á vuestros oidos este nombre." And "la alta Mancha" of I, chapter 52, in the second last sonnet, is compared with the Aeneid, I, 7: "altae moenia Romae"; cf. also *Eneida,* Vol. I, p. 2: "los muros | De la alta, invicta, y generosa Roma." Two passages in *Don Quixote,* II, chapter 18: "enseñarle cómo se han de *perdonar los sujetos,* y supeditar y acocear los soberbios," and II, chapter 52: "mi profesion es *perdonar á los humildes* y castigar á los

soberbios," and perhaps the humorous inversion of I, chapter 52: "Oh humilde con los soberbios y arrogante con los humildes" are aptly compared by Clemencin with the Aeneid, VI, v. 853: "parcere subiectis et debellare superbos." But in a note, Vol. V, p. 375, Clemencin objects to Cervantes's use of *sujetos* for the Latin *subiectis* ("*sujetos* en castellano tampoco significa exactamente lo mismo que en latin"); Cervantes probably took it from the Spanish *Eneida*, Vol. I, p. 294: "A *sobervios* bajar con cruda guerra, | Y *perdonar a humildes y sujetos.*" Sancho's lamentation over his ass: "miserables de nosotros! que no ha querido nuestra corta suerte que muriésemos en nuestra patria y entre los nuestros, etc.," II, chapter 55, was perhaps suggested by the *Eneida*, Vol. I, p. 8: "O tres y quatro veces fortunados | Los que tan gran merced del Cielo uvieron, | Que a vista de sus padres degollados, | Junto al Troyano muro perecieron." Clemencin quotes the original, I, vs. 94 ff. With regard to the phrase: "aquí fué Troya," *Don Quixote*, II, chapter 66, and *El Rufian Viudo*, rather common in Spanish literature, it is possible that it owes its origin to the translation of II, v. 325 of the Aeneid, "fuimus Troes, fuit Ilium, etc."; cf. *Eneida*, Vol. I, p. 70: "Troyanos fuimos. | Ya Troya fue, etc.," and p. 99: "A la hora la ribera y puerto dejo | Y campos donde Troya fue, etc.," which is the "litora cum patriae lacrimans portusque relinquo | et campos ubi Troia fuit," III, vs. 10-11. In the *Cancion de Grisóstomo, Don Quixote*, I, chapter 14, "el agorero | Graznar de la corneja, etc." has its indirect source in Virgil, Eclogues, IX, 15: "ante sinistra cava monuisset ab ilice cornix" (falsely introduced by some into Eclogue I also, after verse 17), and Georgics, I, v. 388: "tum cornix plena pluviam vocat improba voce, etc."; Garcilaso (Egloga I) has: "Bien claro con su voz me lo decia | La siniestra corneja, prediciendo | La desventura mia, etc."; and Luis de Leon, *Obras, op. cit.*, p. 18, col. 1, translates thus: "lo decia | La siniestra corneja desde luego," and p. 26, col. 2, "y si ya la corneja con su canto . . . no me inclinara, etc." While Cervantes knew Garcilaso well, he could have known Luis de Leon only in manuscript. The verse "que a osados favorece la Fortuna," *Eneida*, Vol. II, p. 115, and Aeneid X, v. 284: "audentis Fortuna iuvat" seems to have been taken directly from Gregorio Hernández into *Don Quixote;* cf. the first poem with unfinished verse-ends, line 19, "que a osa [dos] | Favorece la fortu [na]." It represents

a common Latin proverb with variations; cf. Terence, Phor. I, 4, 26; Cicero, Tusc. disp. 2, 4, 11; Tibullus, I, 2, 16; Ovid, Met. X, 586, etc.; cf. p. 500, n. 3.

10. The handsome appearance of the chief personages has already been noted, p. 506, n. 2; they are of lofty descent also. Aeneas is "de linaje de inmortales," Vol. I, p. 37; Dido is a queen, Creusa and Lavinia are princesses. Periandro and Auristela are of royal blood; "de nobilísimos padres nacido," the former says, while most of the other characters of the *Persiles* are of an aristocratic lineage. This is the case with most of the romances of this character.

11. The early editions of Mena's *Theagenes y Chariclea* have a marginal reference to the Aeneid apropos of Chariklea (cf. Vol. I, p. 214, edition 1787) suggesting a comparison between the Greek maiden and Camilla, Virgil's martial maid. It is possible that Cervantes's warlike female character, Sulpicia, owes something to Camilla; cf. *Persiles,* p. 612, col. 1: "su capitana, armada de un coselete blanco, . . . y traia puesta la gola, pero no las escarcelas ni los brazaletes, el morrión sí, que era de hechura de una enroscada sierpe . . . tenia un venablo en las manos, . . . con una gran cuchilla de agudo y luciente acero forjada, con que se mostraba tan briosa y tan gallarda, que bastó á detener su vista la furia de mis soldados, etc."

12. In the typical romance of adventure, dreams and portents of various kinds are of frequent occurrence. We saw that it was so in the case of *Theagenes and Chariklea;* in the Aeneid wonders and omens are just as common, and it must have contributed in those features, also, to the make-up of the travel-yarn. To give a few examples, cf. *Eneida,* Vol. I, p. 24, Dido sees the image of her dead husband in her dreams; p. 67, Aeneas sees Hector; p. 140, Dido is disturbed by visions in her dreams; p. 91, a flame plays about the hair and temples of Ascanius; p. 100, the miracle of Polydorus; p. 104, an ominous earthquake; p. 118, Helenus prophesies to the Trojans; p. 175, Aeneas is urged to flee by a divine messenger; p. 286 ff., Anchises prophesies to Aeneas. For a detailed discussion of all the miraculous elements in the Aeneid, cf. Professor Franz Kunz, *Realien in Virgils Aeneis,* "Programmarbeit" (K. K. Staats-Ober-Gymnasium zu Wiener-Neustadt) Wiener-Neustadt, 1895, and Heinze, *op. cit.,* p. 306 ff.

Persiles, p. 613, col. 2, Periandro's dream, and the vision of

Auristela; p. 645, prophesy concerning the banishment of the moriscos; p. 656, col. 2, Soldino foretells events; p. 669, col. 1, the painting of "personajes ilustres que estaban por venir"; cf. also article II, p. 26, for further examples in the *Persiles.*

13. Finally the use of the word *fortuna,* the spirit of which was explained in article II, p. 27 as dominating the career of the chief personages of a romance of adventure, must be considered. Though it was used frequently in Heliodorus, it is even more common in Virgil and thus helps to lend the Aeneid an atmosphere which differs little in its features of adventure, at least, from the *Theagenes and Chariklea* and the *Persiles. Eneida,* Vol. I, p. 42: "que por trabajos varios y tormentos | De igual fortuna he sido yo arrojada;" p. 55: "Yo triste, a quien fortuna ha asi abatido"; p. 74: "Siendo fortuna al buen principio pia," and "vamos por do muestra | Camino de salud fortuna diestra"; p. 89: "qué contento | Podia Fortuna darme que bastase?"; p. 92: "O bajo, o alto la Fortuna ruede | Nunca de ti jamás podrá apartarme." Dozens of examples could be added. *Fortuna* in the sense of *storm* also occurs, p. 37: "al mar volvamos Siciliano | De do nos arrojó fortuna insana."

In the *Persiles* Fortuna with her wheel is personified on p. 567, col. 1, and p. 629, col. 1; other examples of a common usage are, p. 576, col. 1: "la nuestra hasta hoy contraria fortuna; p. 577, col. 1: "si . . . la fortuna no me desfavorece"; p. 582, col. 1: "para que viese si la fortuna te habia llevado á su poder"; p. 594, col. 1: "el punto en que le ha levantado la fortuna"; cf. also, p. 585, col. 2: "miserables son y temerosas las fortunas del mar." The use of the word is very common in the rest of Cervantes's works as well as in Spanish literature before his time. One is therefore led to the conclusion that *fortuna* is probably an inheritance from those classics which became known during the Renaissance, for it is especially common from the end of the fifteenth century on.

Virgil's *Fama* (bk. IV), *Eneida,* Vol. I, p. 150 ff., with many tongues, is mentioned in the *Persiles,* p. 618, col. 2: "los verdaderos . . . amantes en quien la fama ocupa sus lenguas." On p. 606, col. 2, the figure of *Diligencia* which "antes pareciera Fama" is described as having *alas* all over her body. Virgil distinctly says *plumae,* but the Spanish *Eneida,* Vol. I, p. 151, has "quantas plumas tiene en cuerpo y *alas,* and Cervantes may have recalled only the latter.

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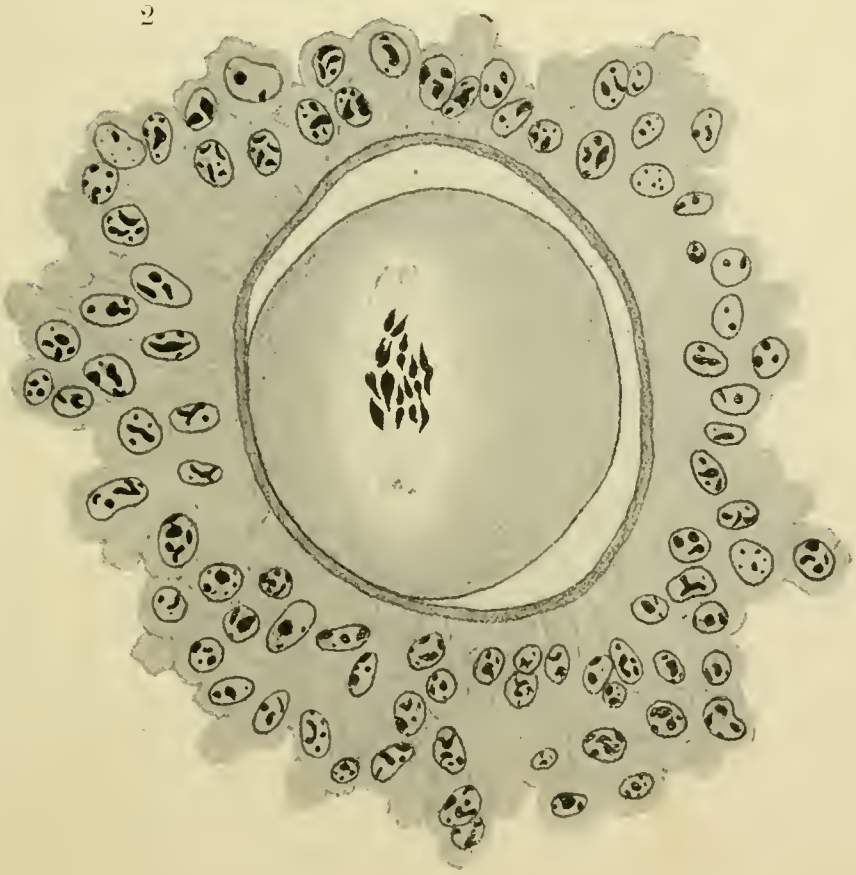

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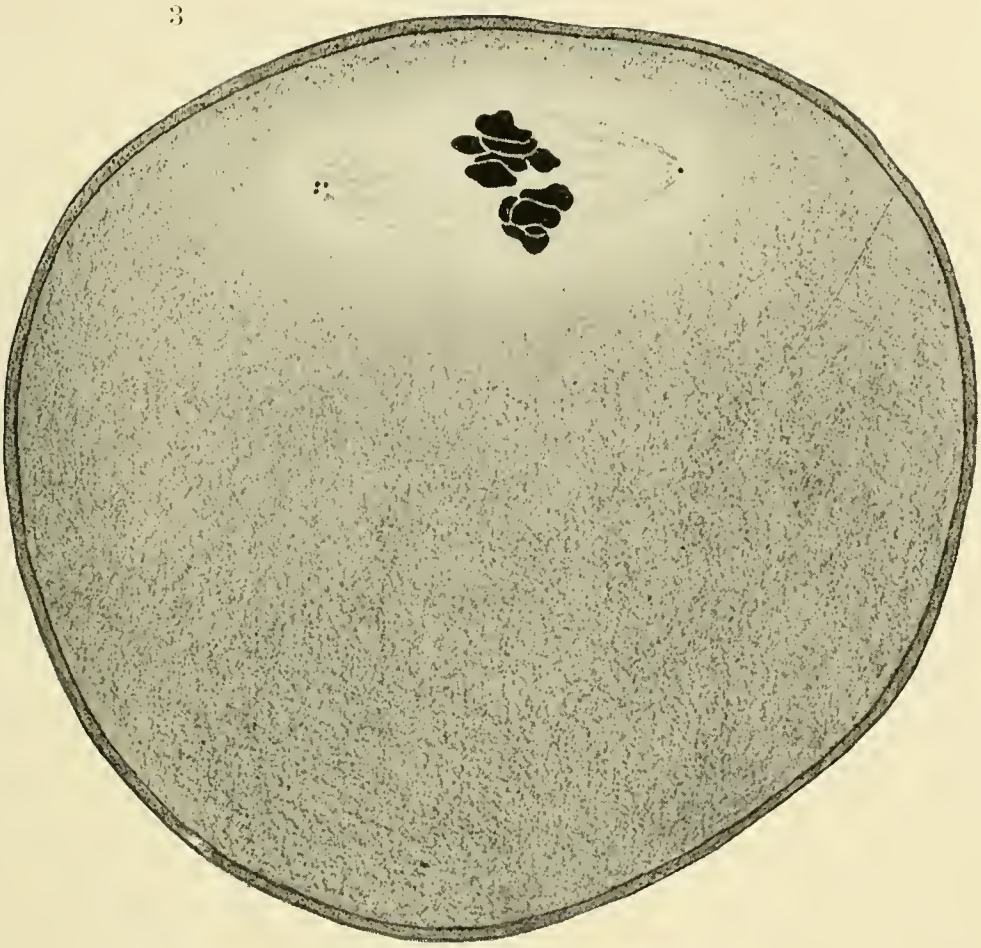

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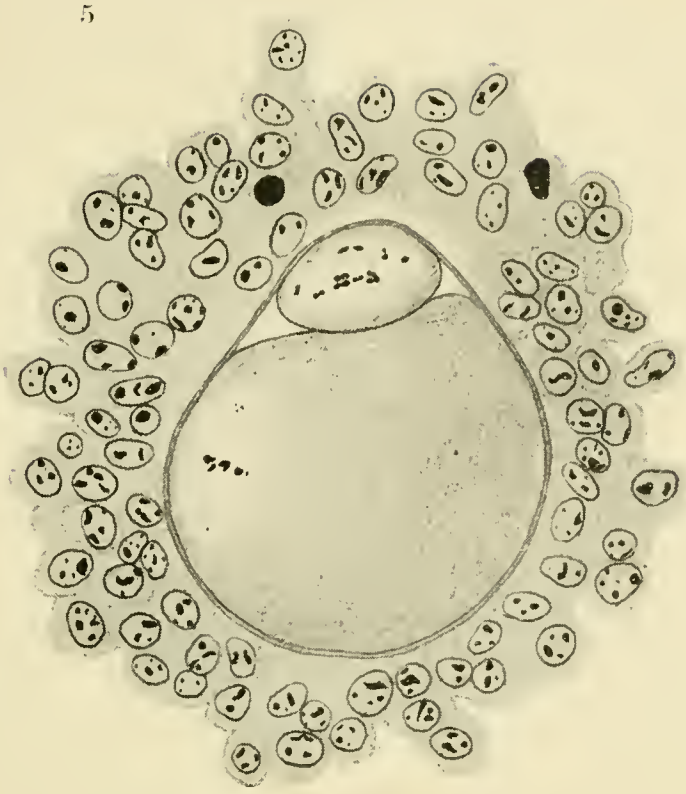

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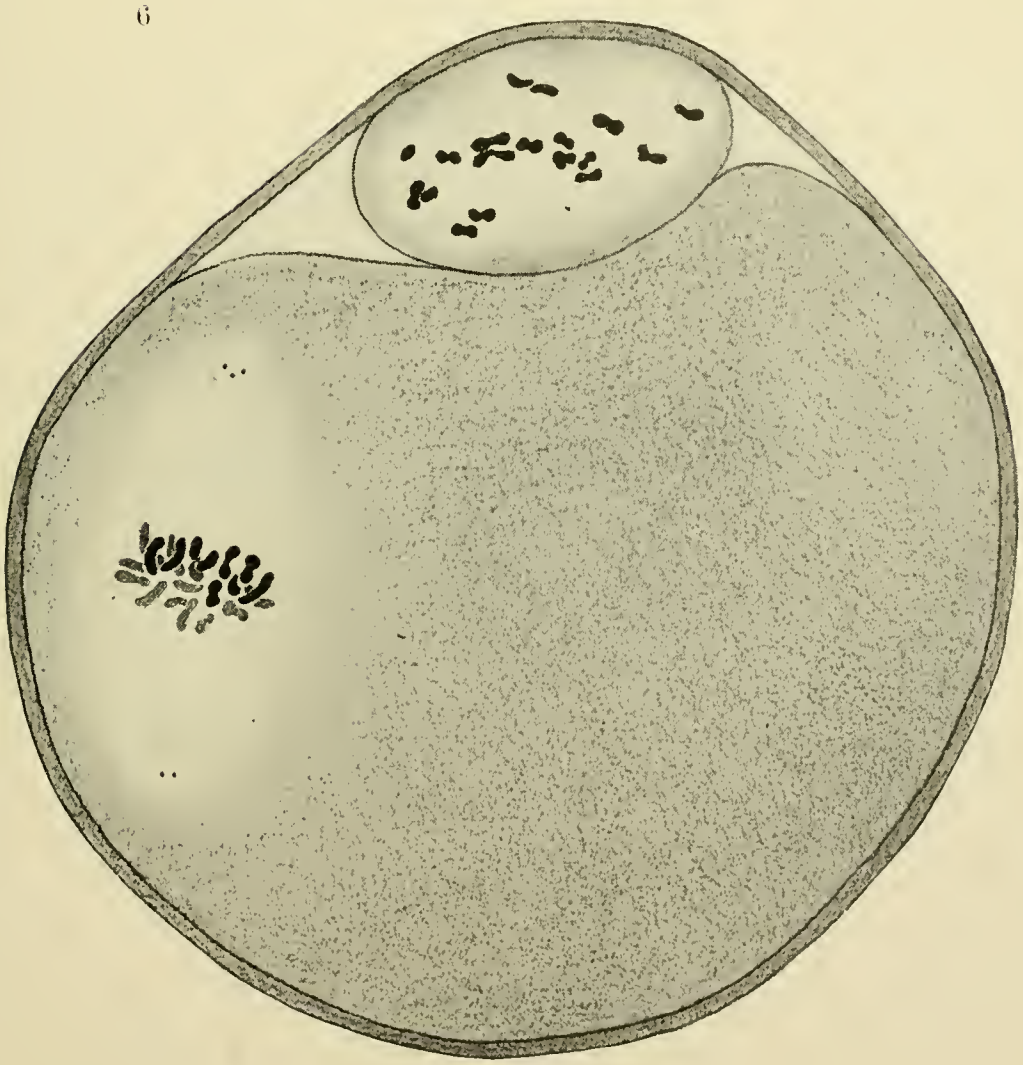

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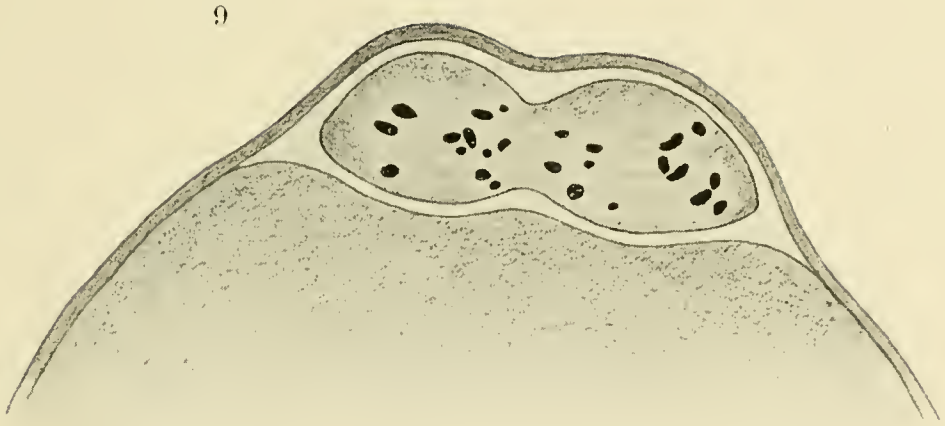

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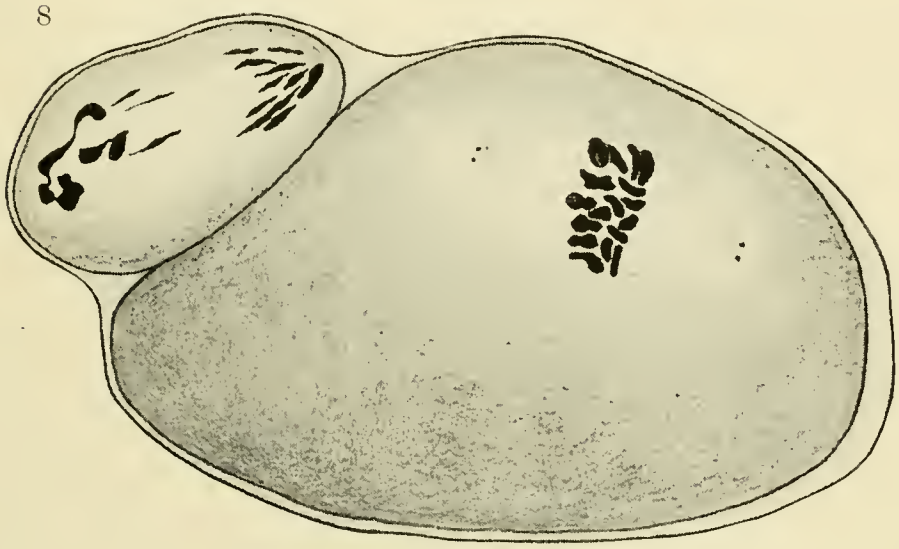

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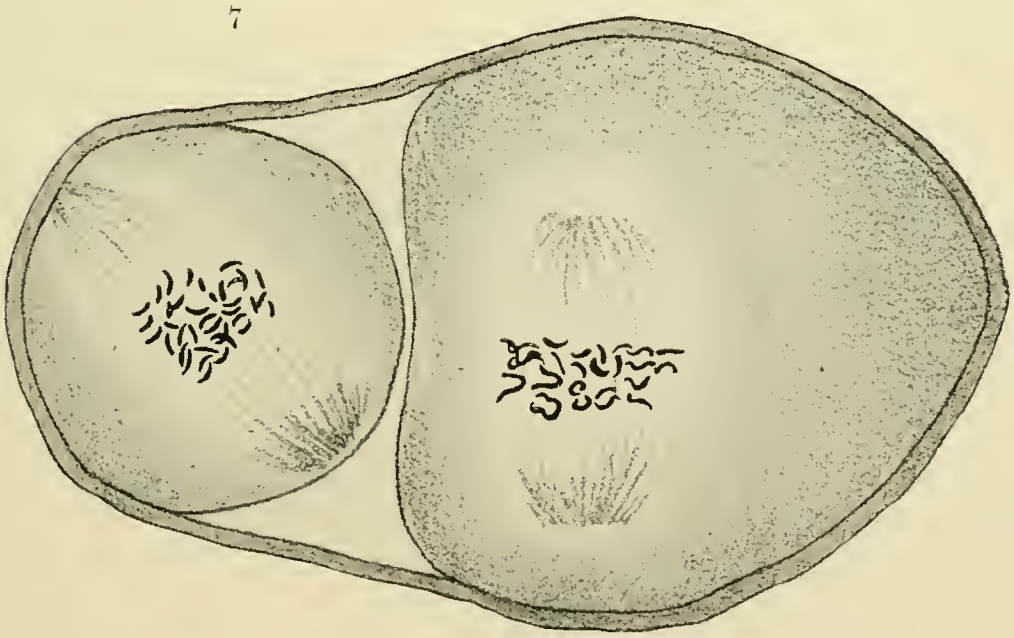

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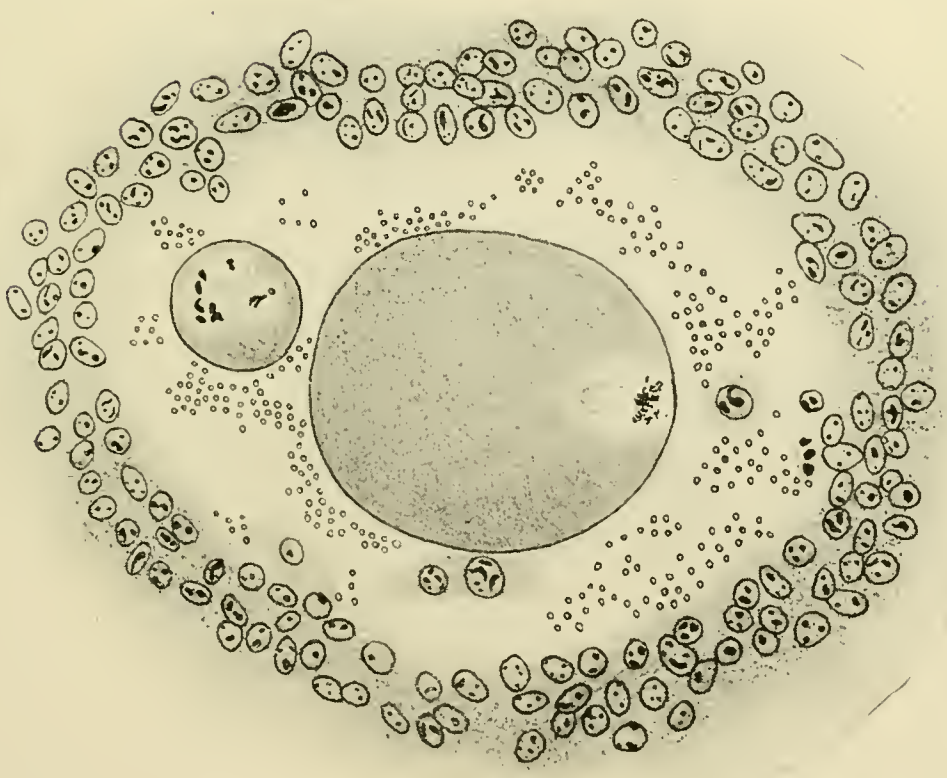

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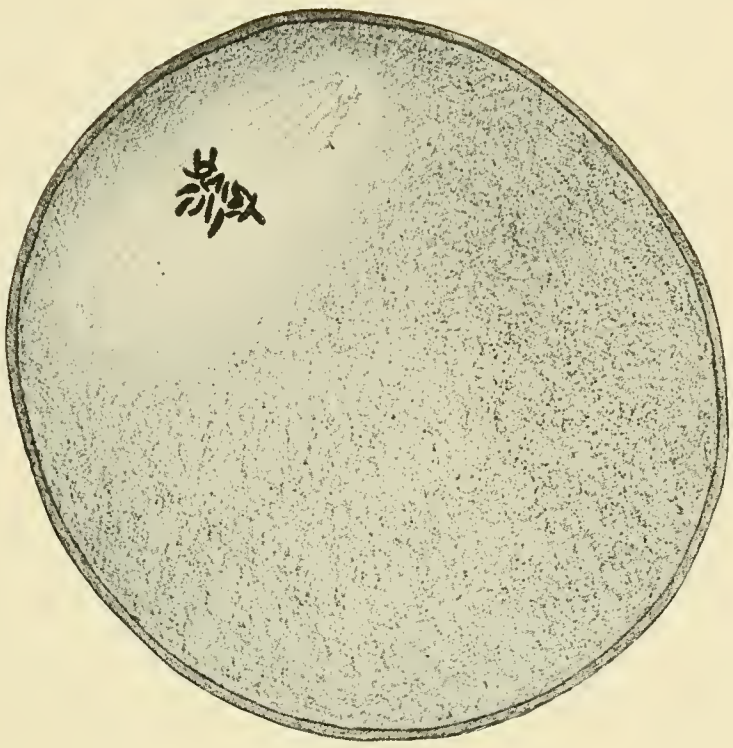

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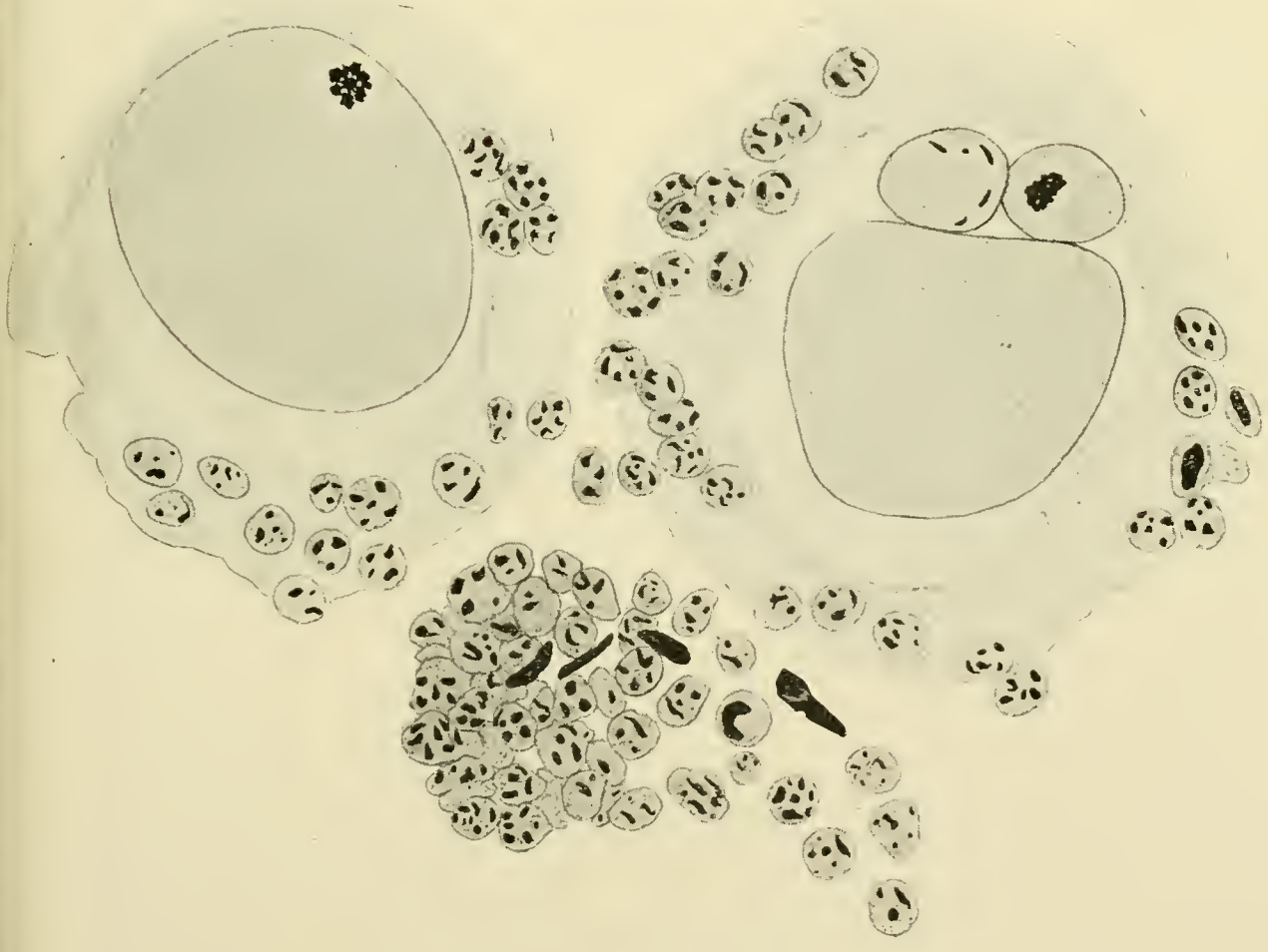

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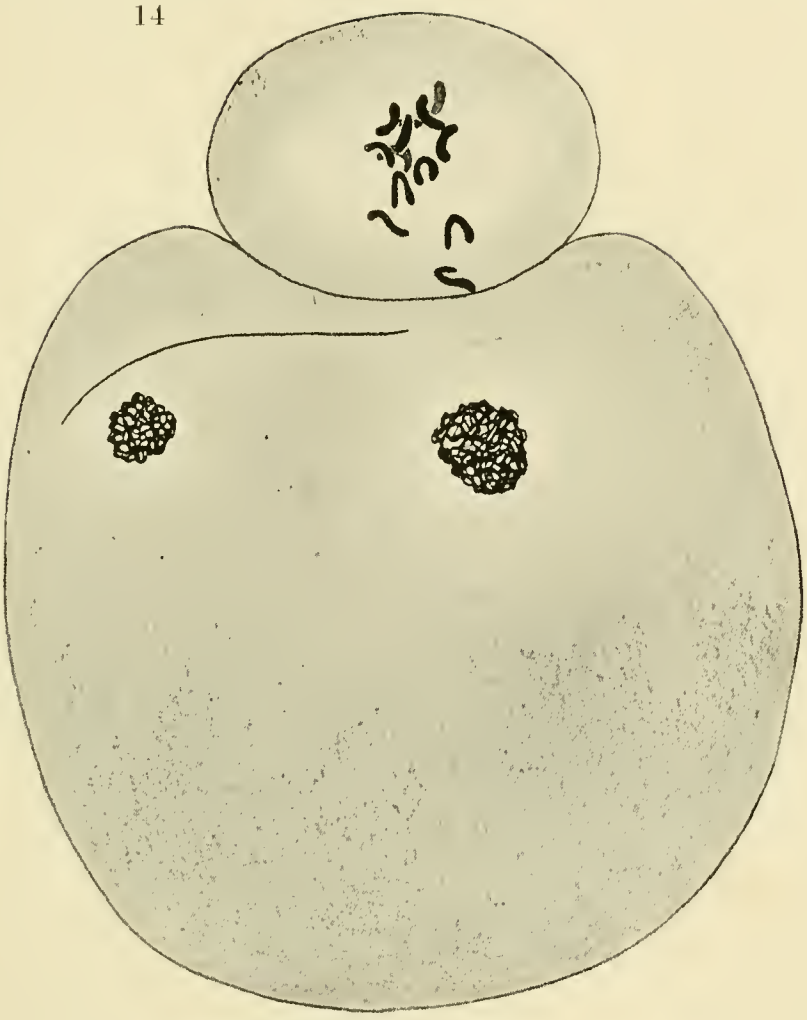

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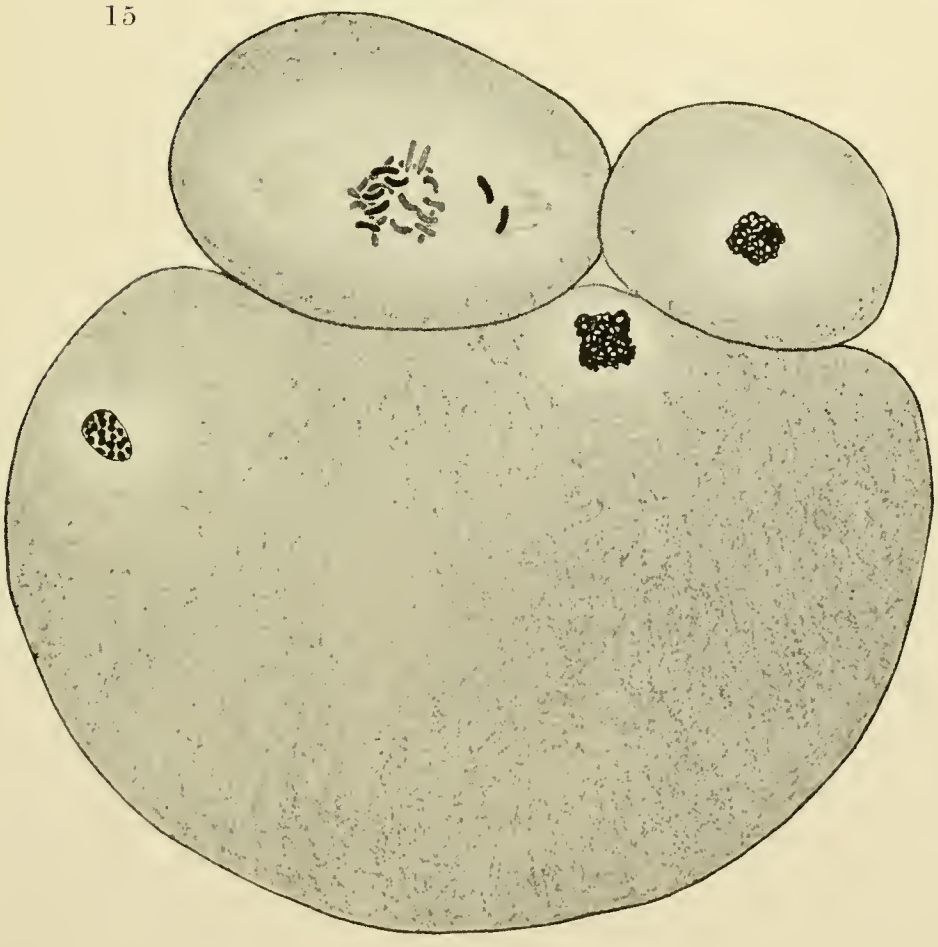

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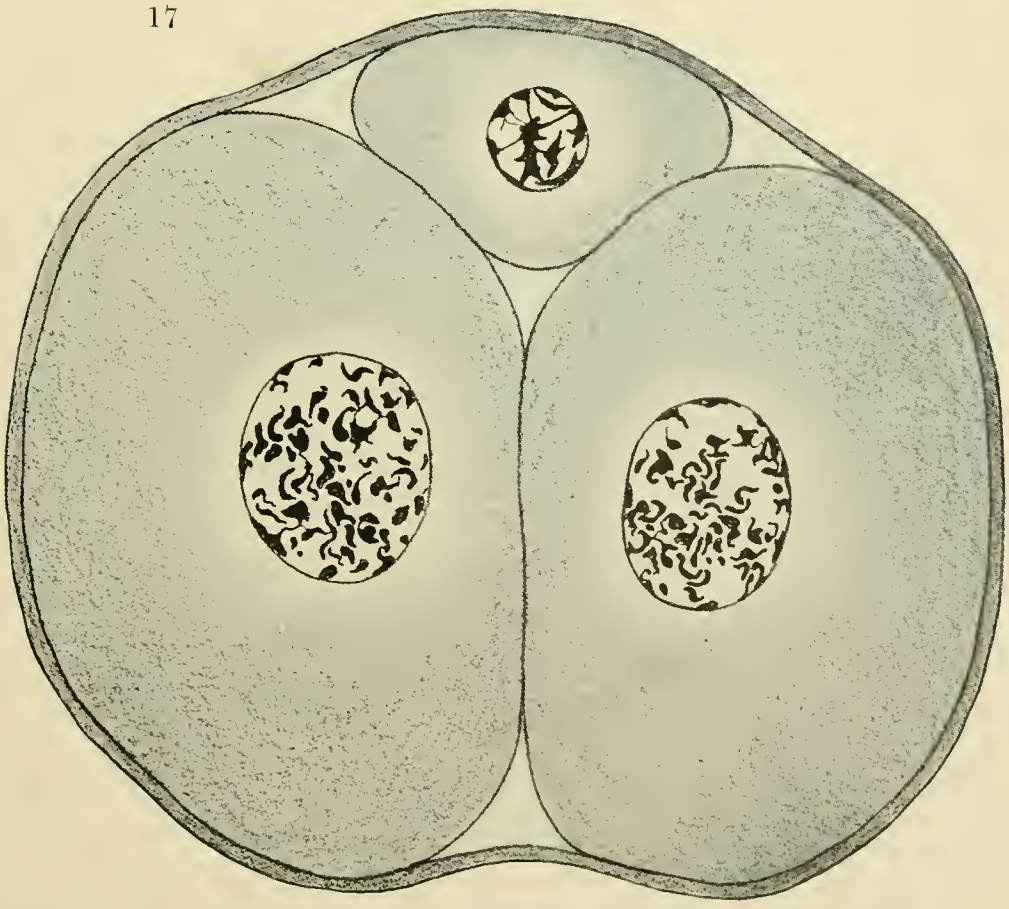

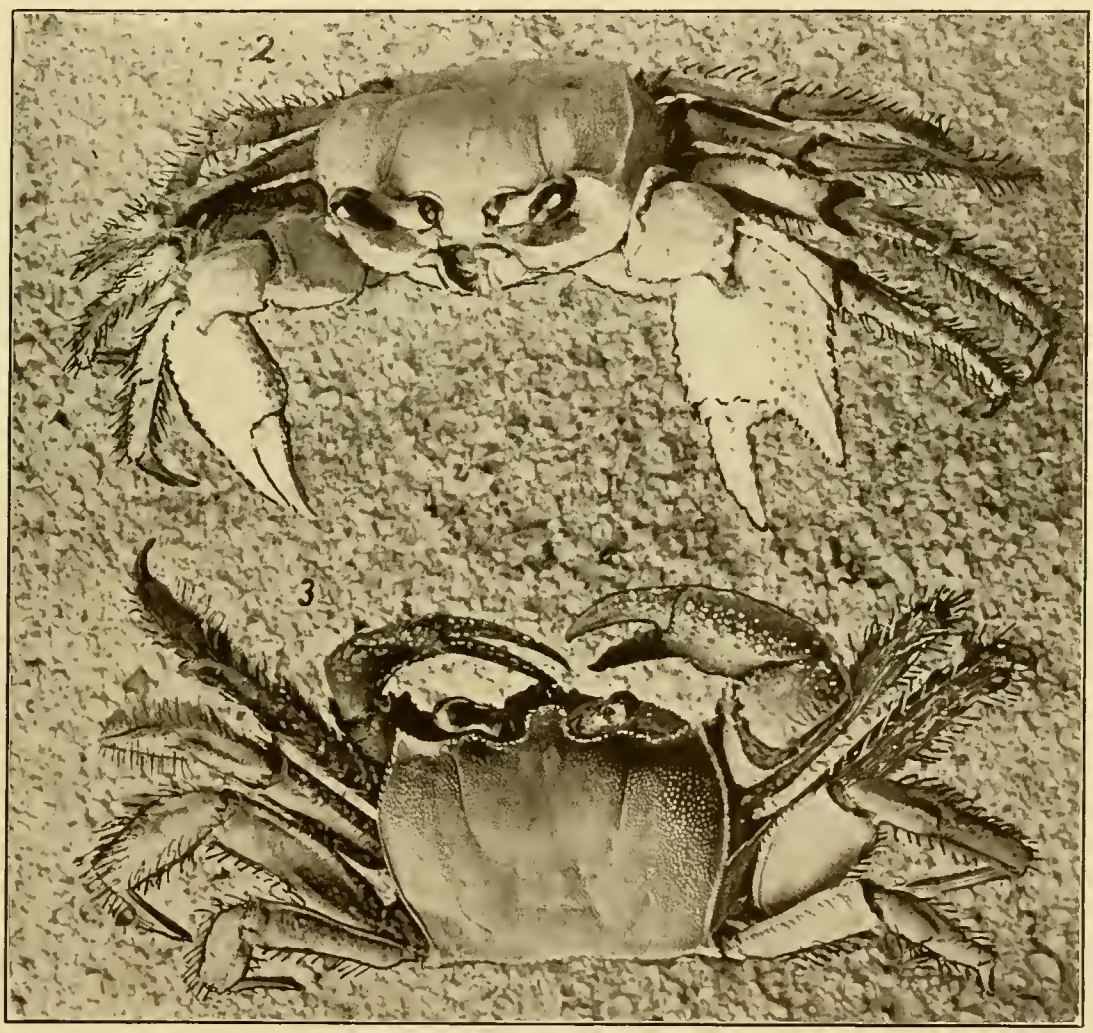

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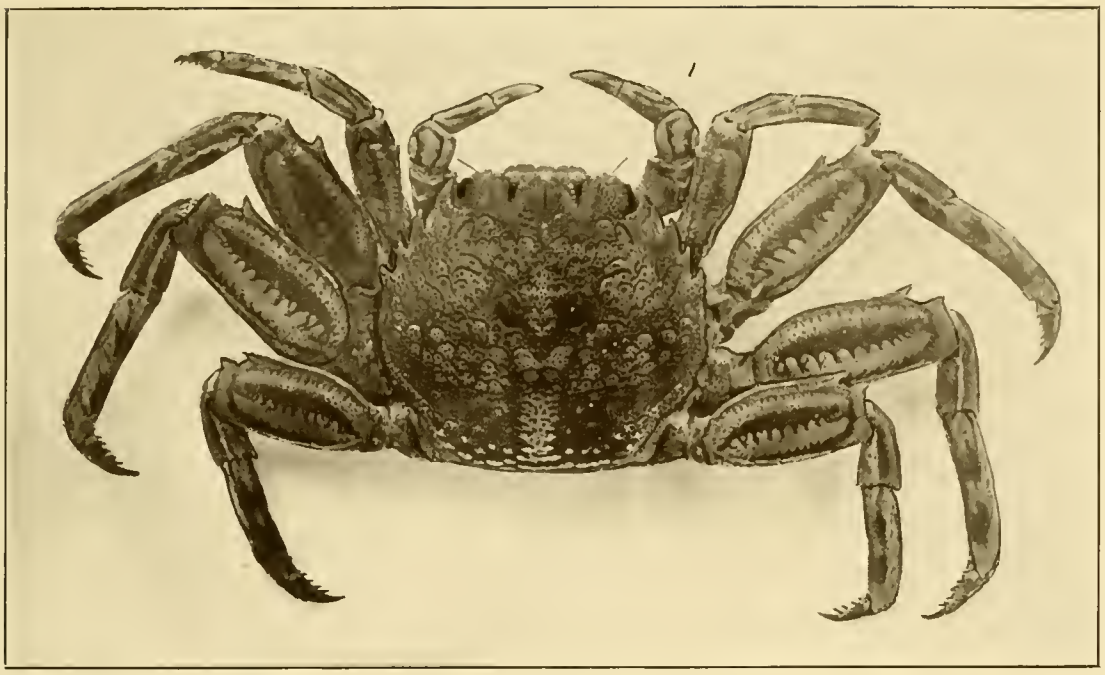
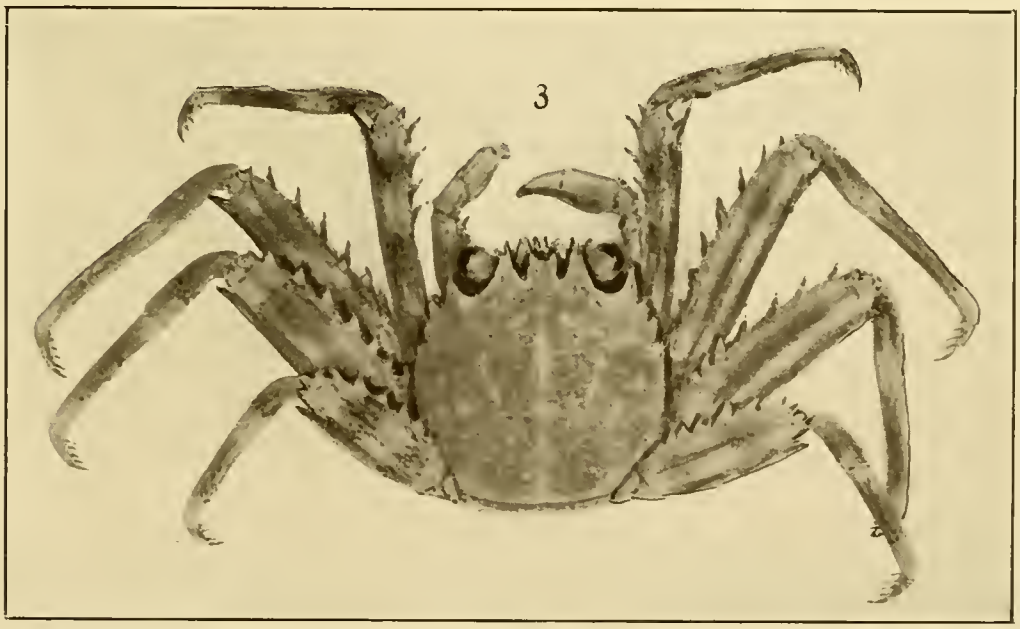
BERMUDA CRUSTACEA.

1. Land Crab, *Cardisoma guanhumi;* 2, 3. Beach Crab, *Ocypode arenarius.*

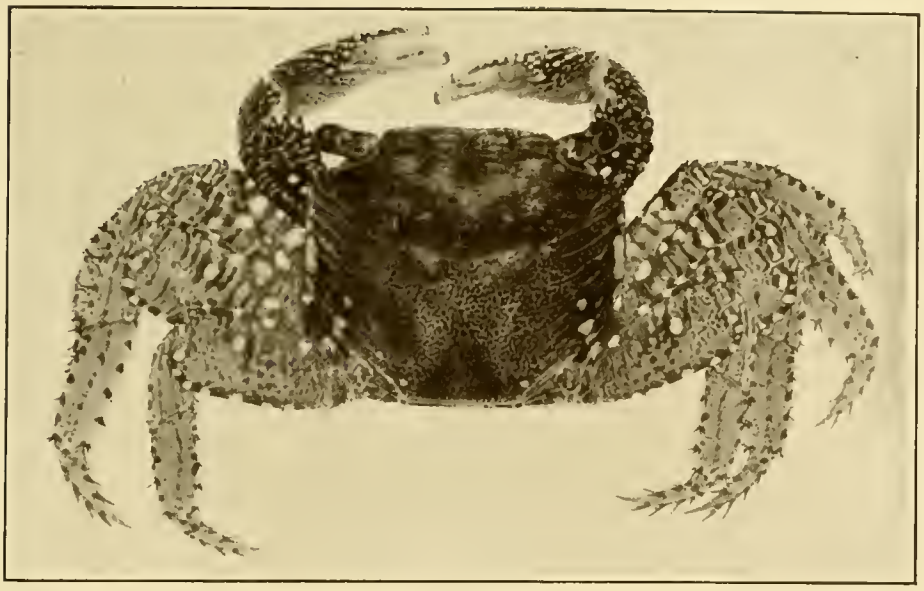


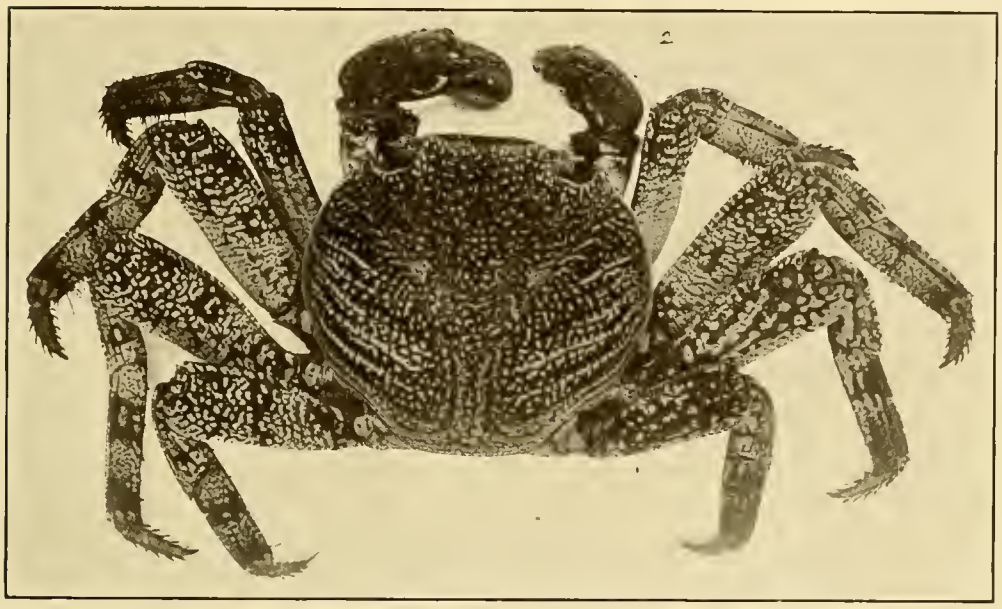


A. H. Verrill, phot. Stoddard & Brown, eng.

1. Cliff Crab, *Plagusia depressa ;* 2. *Sesarma Ricordi ;* 3. *Percnon planissimum ;* 6. *Grapsus grapsus.*

1





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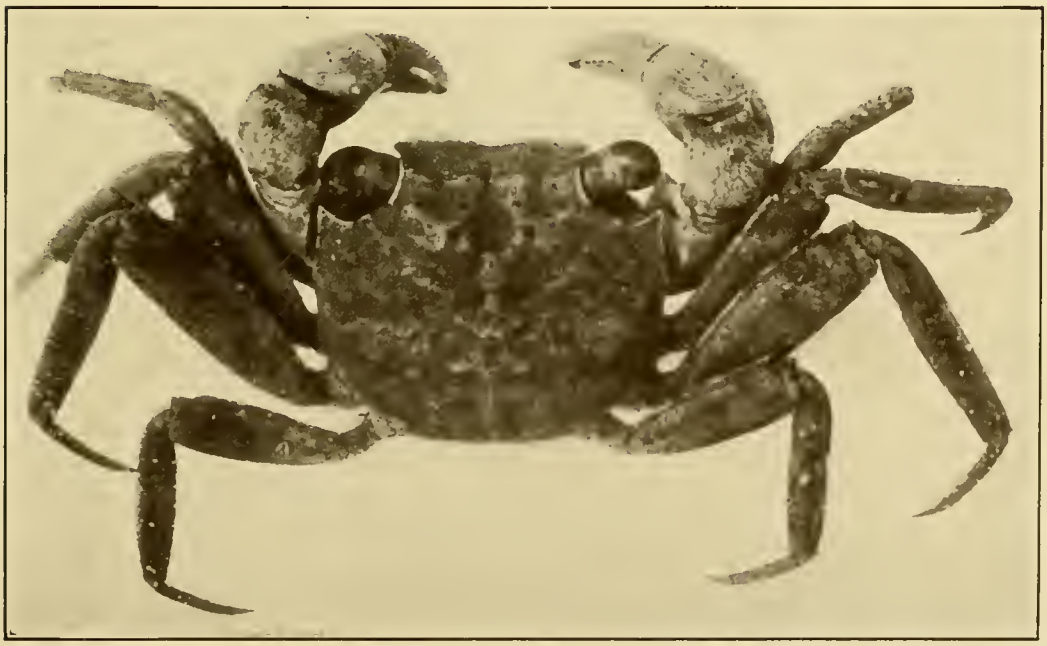
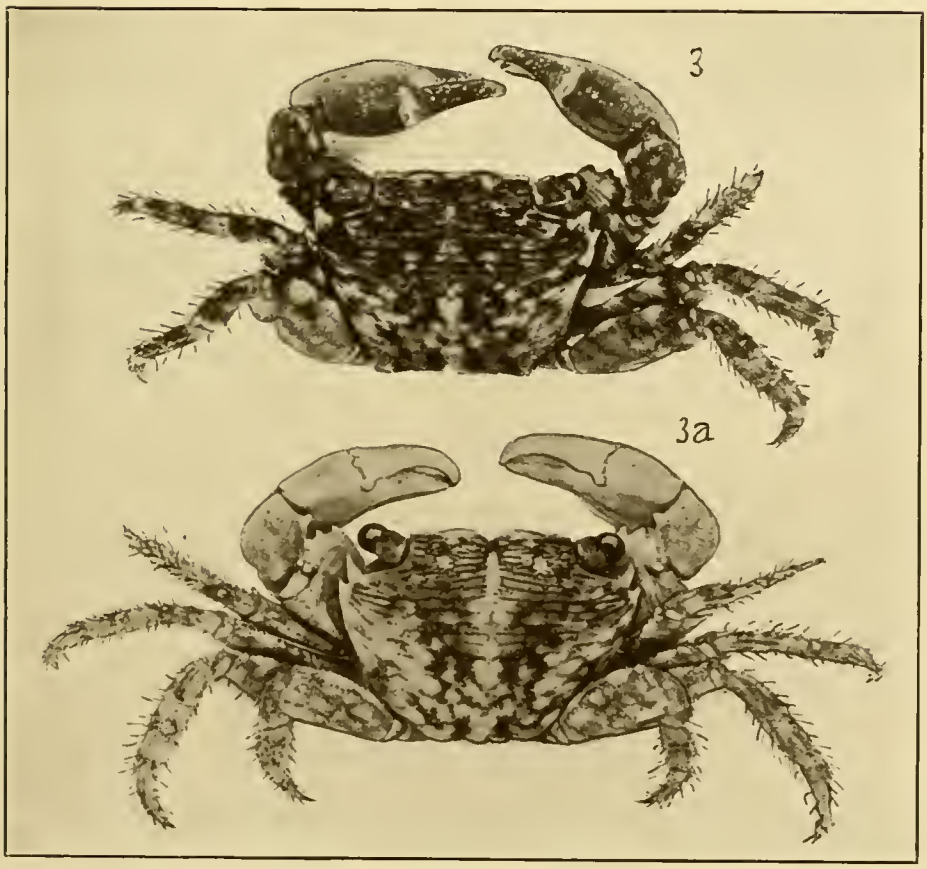


1. *Goniopsis cruentatus;* 2. *Grapsus grapsus;* 3. *Sesarma Ricordi*, var. *terrestris*, nov.



1. *Cyclograpsus integer*; 2. *Pachygrapsus gracilis*; 3, 3*a*, 3*b*. *P. transversus*; 4. *Percnon*; 4*a*. *Goniopsis*; 5. *Sesarma Miersii*.

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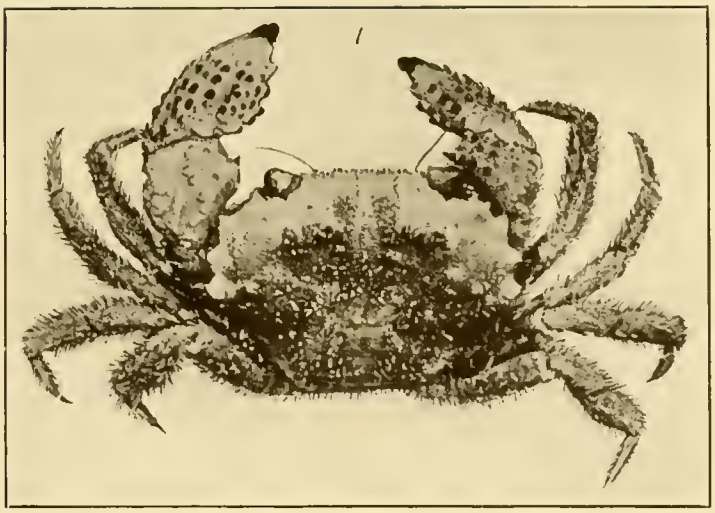
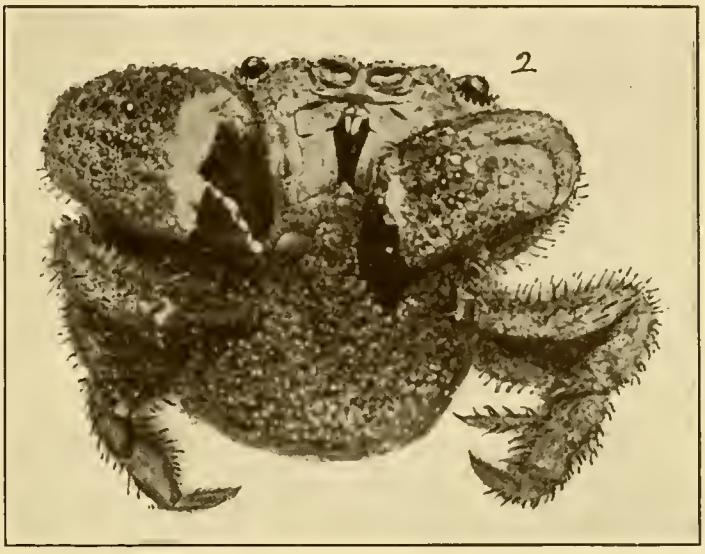
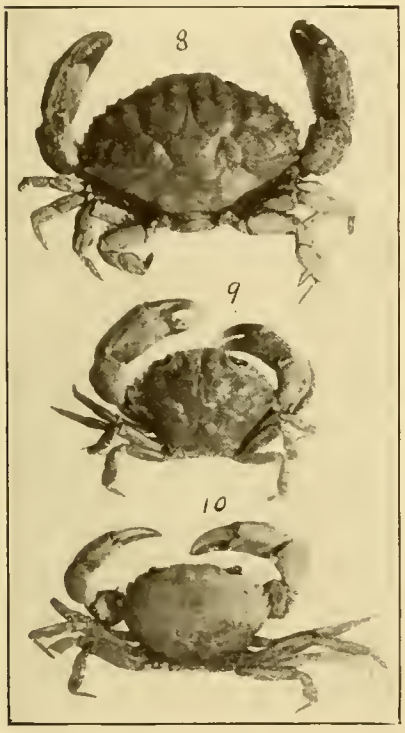
Stoddard & Brown, eng.

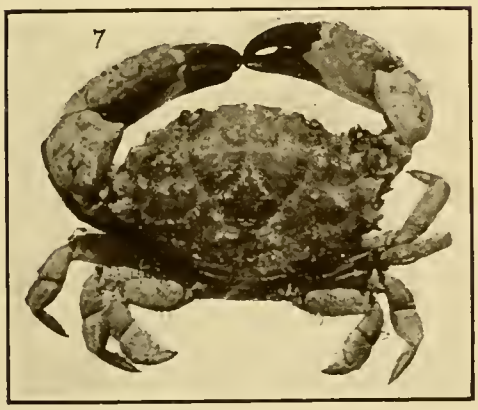
BERMUDA CRUSTACEA.

Gulf-weed Crab, *Planes minutus*, showing variations.

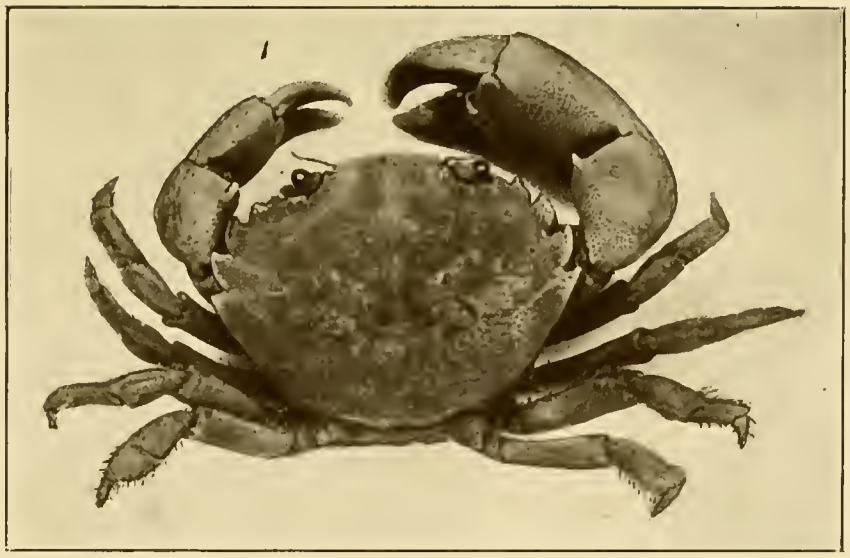


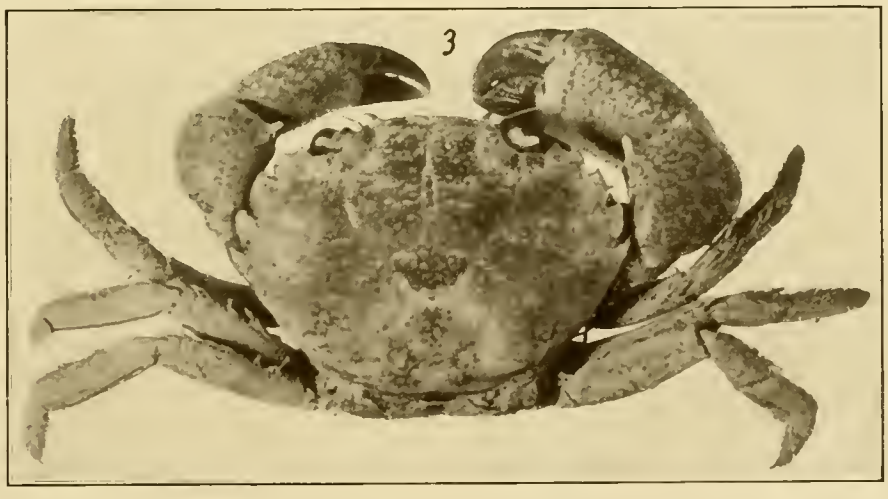






BERMUDA CRUSTACEA.

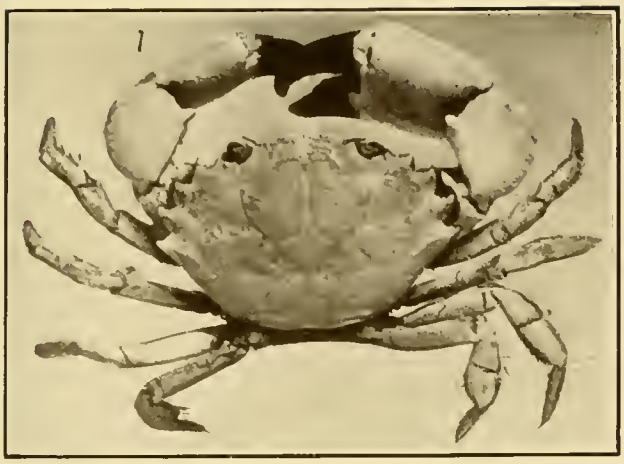


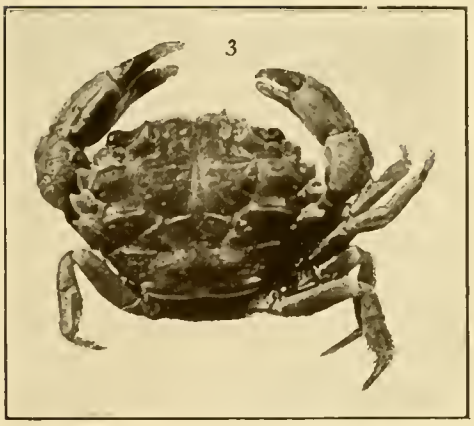


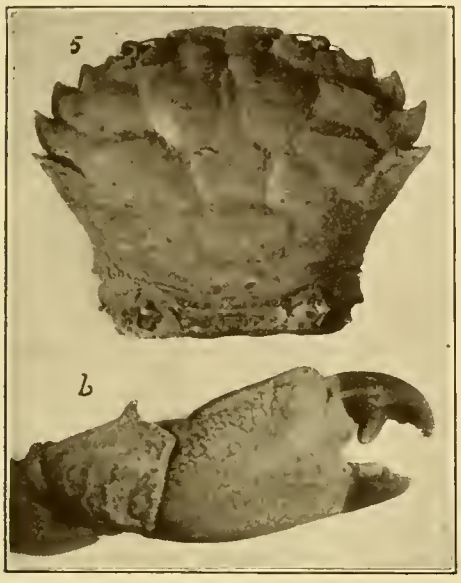
A. H. Verrill, phot. Stoddard & Brown, eng.

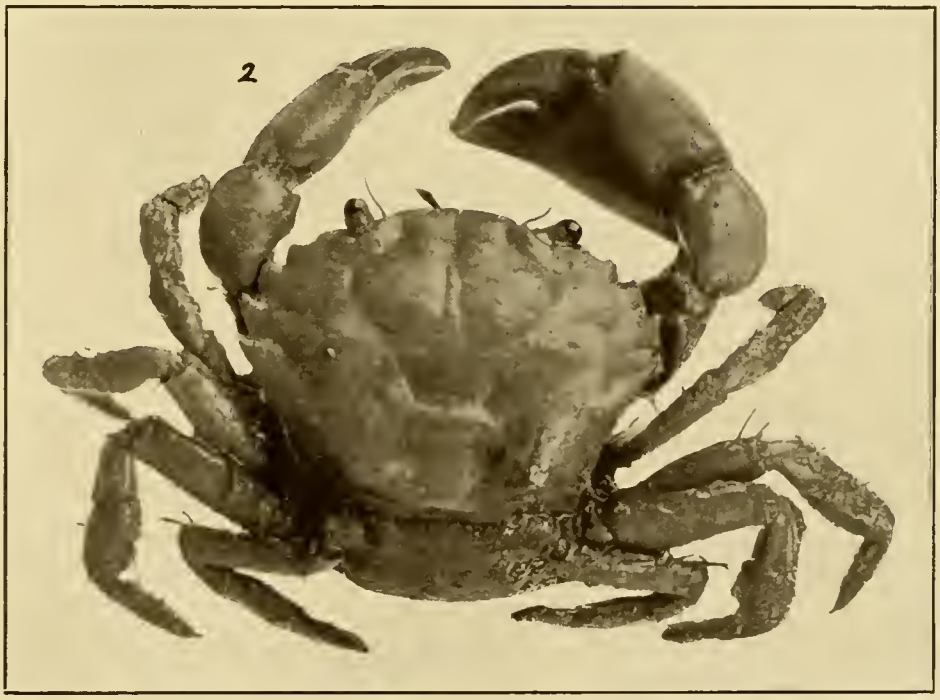
BERMUDA CRUSTACEA.

1. *Eupanopeus Herbstii*, var. *obesus*; 2. *E. Herbstii*, var. *minax*; 3. *E. Herbstii*.



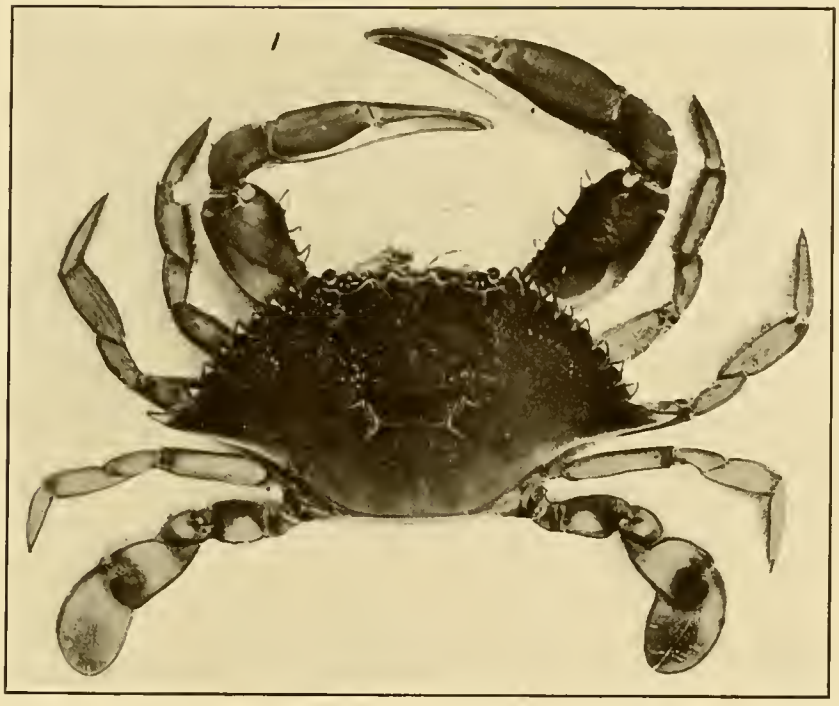






BERMUDA CRUSTACEA.

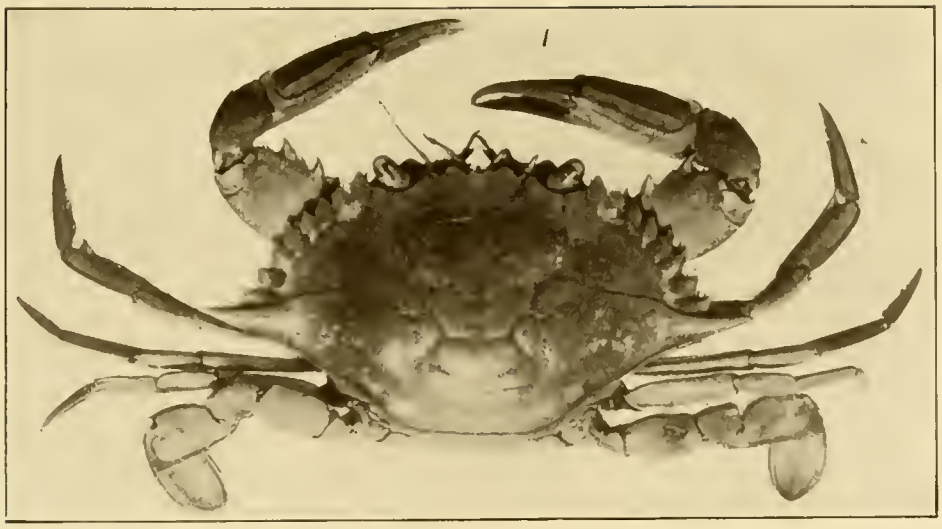
1, 5. *Eupanopeus serratus;* 2. *E. occidentalis;* 3, 4. *E. bermudensis.*

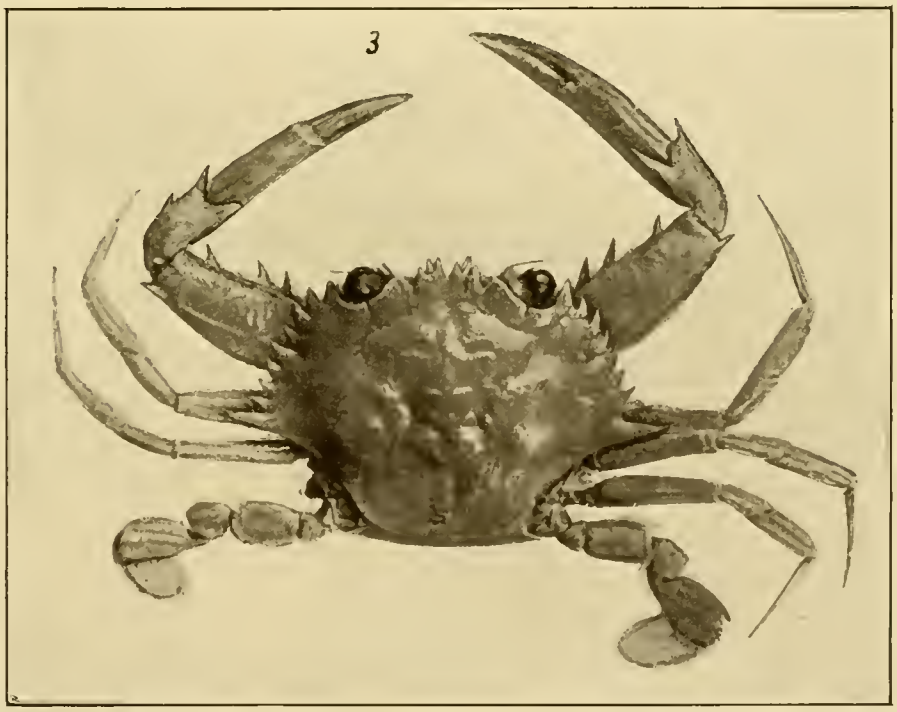


A. H. Verrill, phot. Stoddard & Brown, eng.

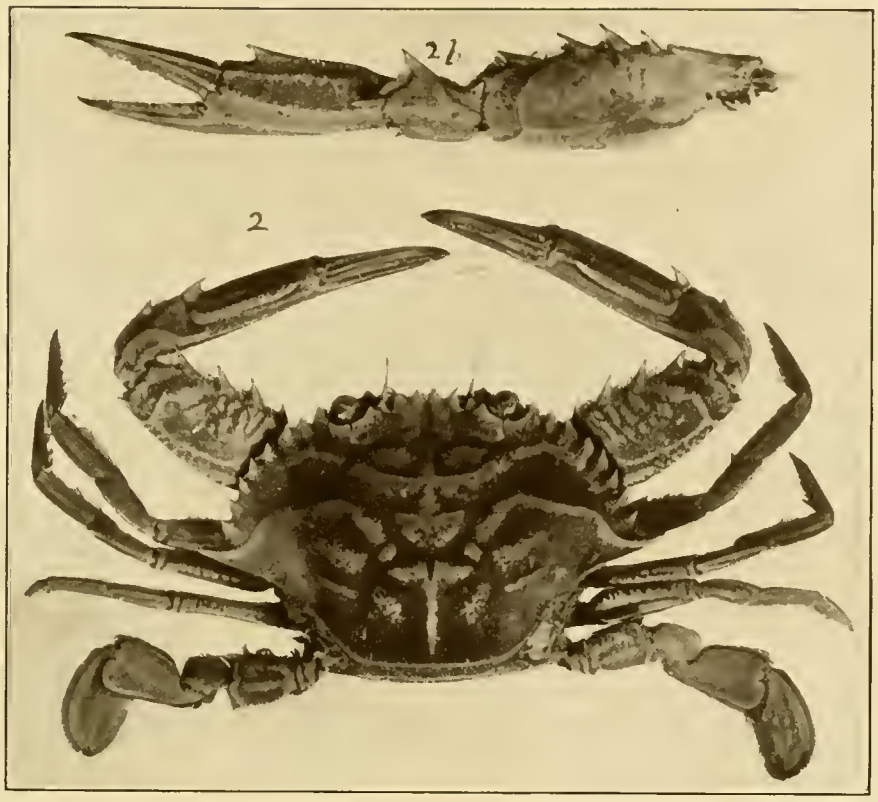
BERMUDA CRUSTACEA.

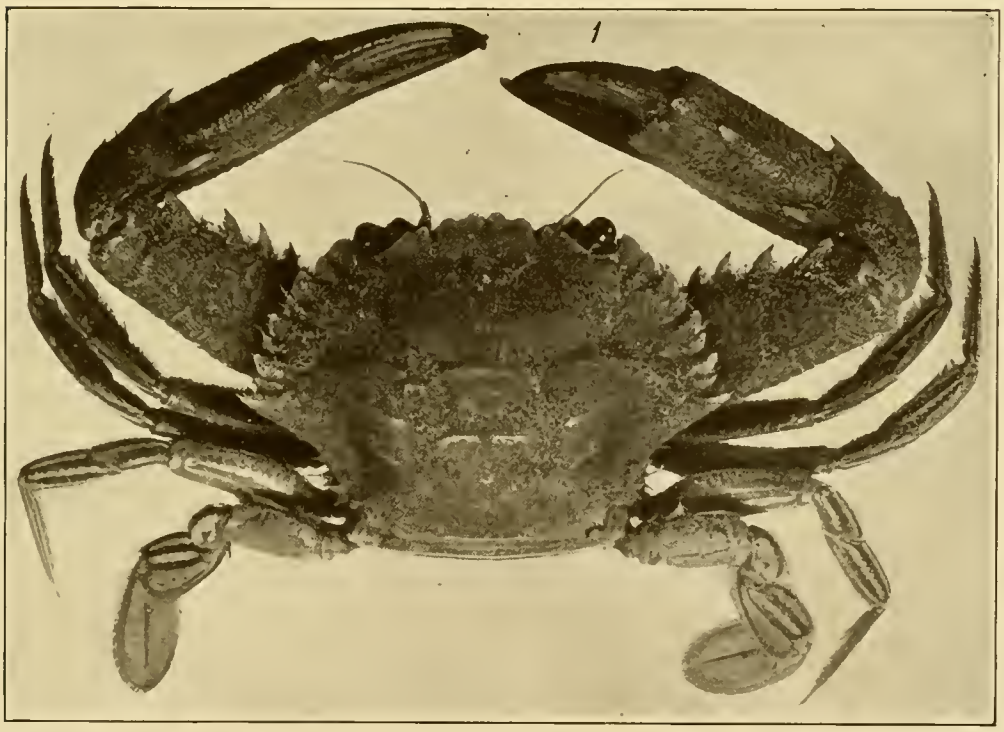
1. *Callinectes ornatus;* 2. Blue or Edible Crab, *Callinectes sapidus.*





1. *Callinectes marginatus, larvatus ;* 2. Gulf-weed Swimming Crab, *Portunus Sayi ;* 3. *Achelous Ordwayi.*





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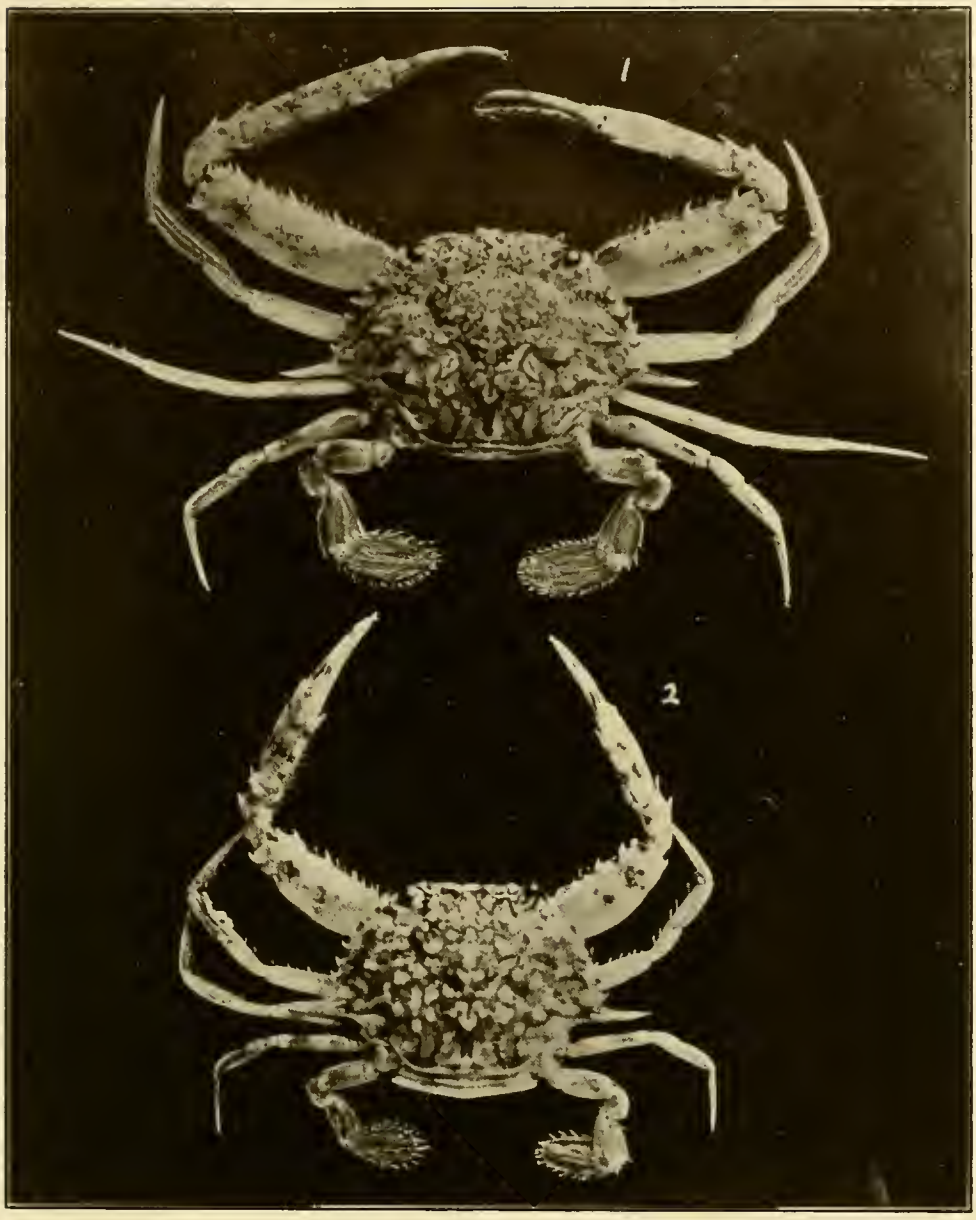
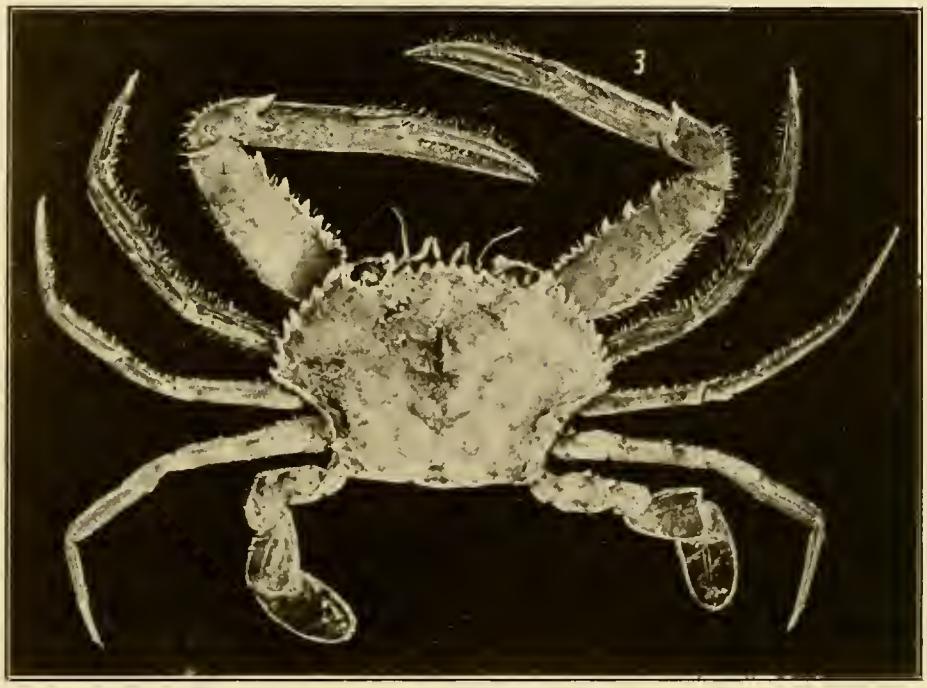
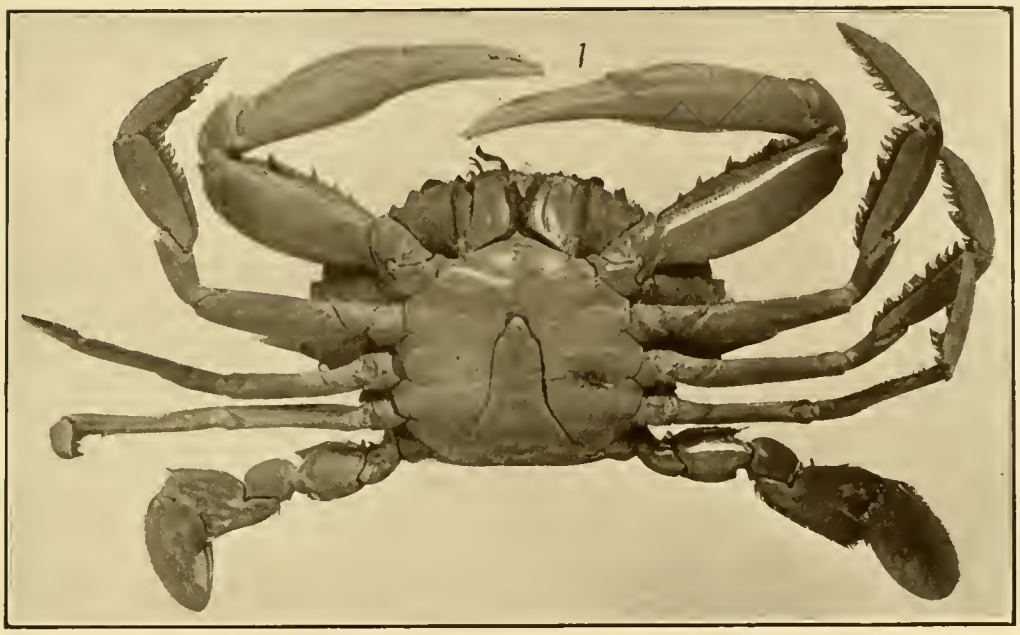
BERMUDA CRUSTACEA.

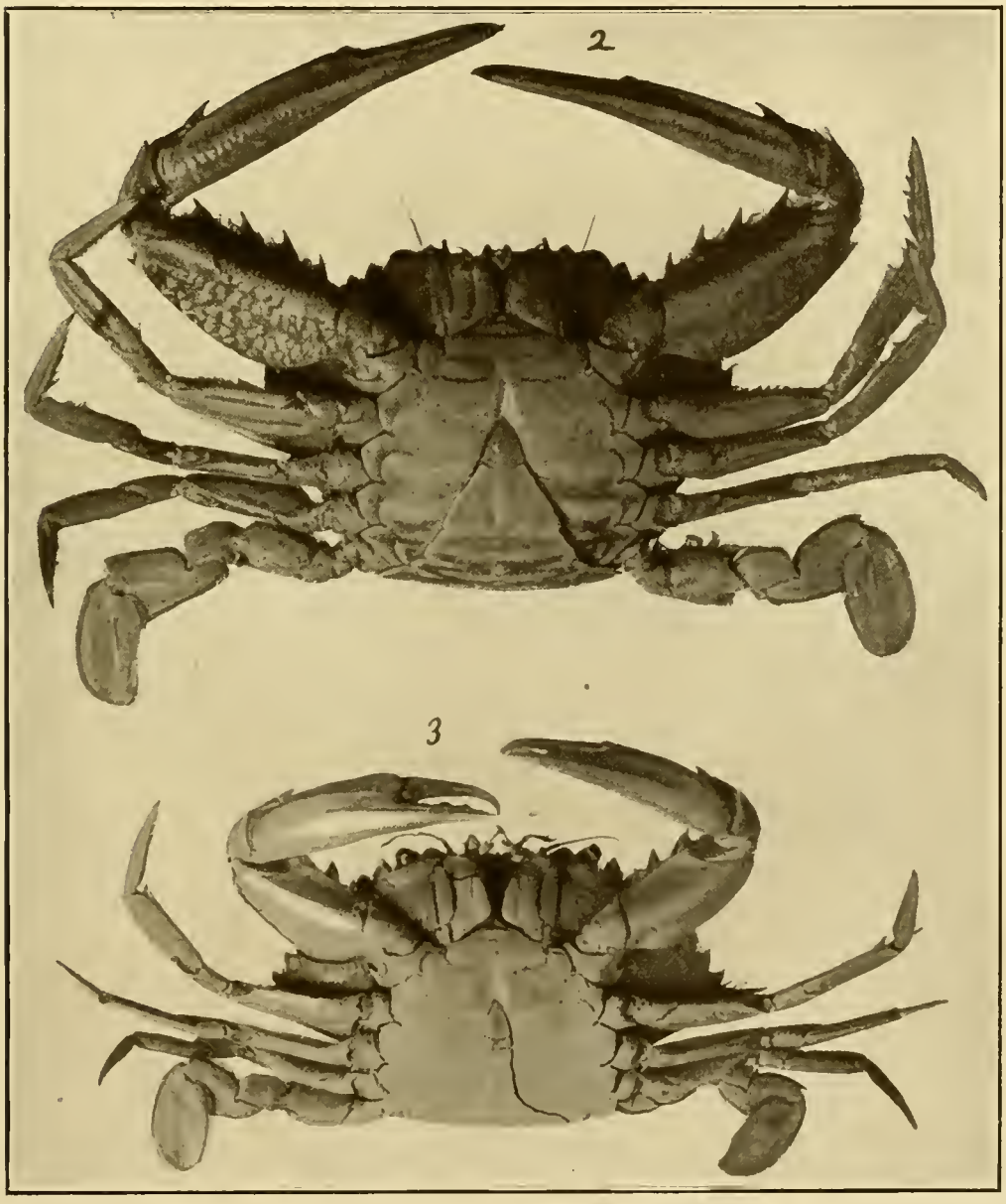
1. *Charybdella tumidula*; 2. *Achelous Smithii*.



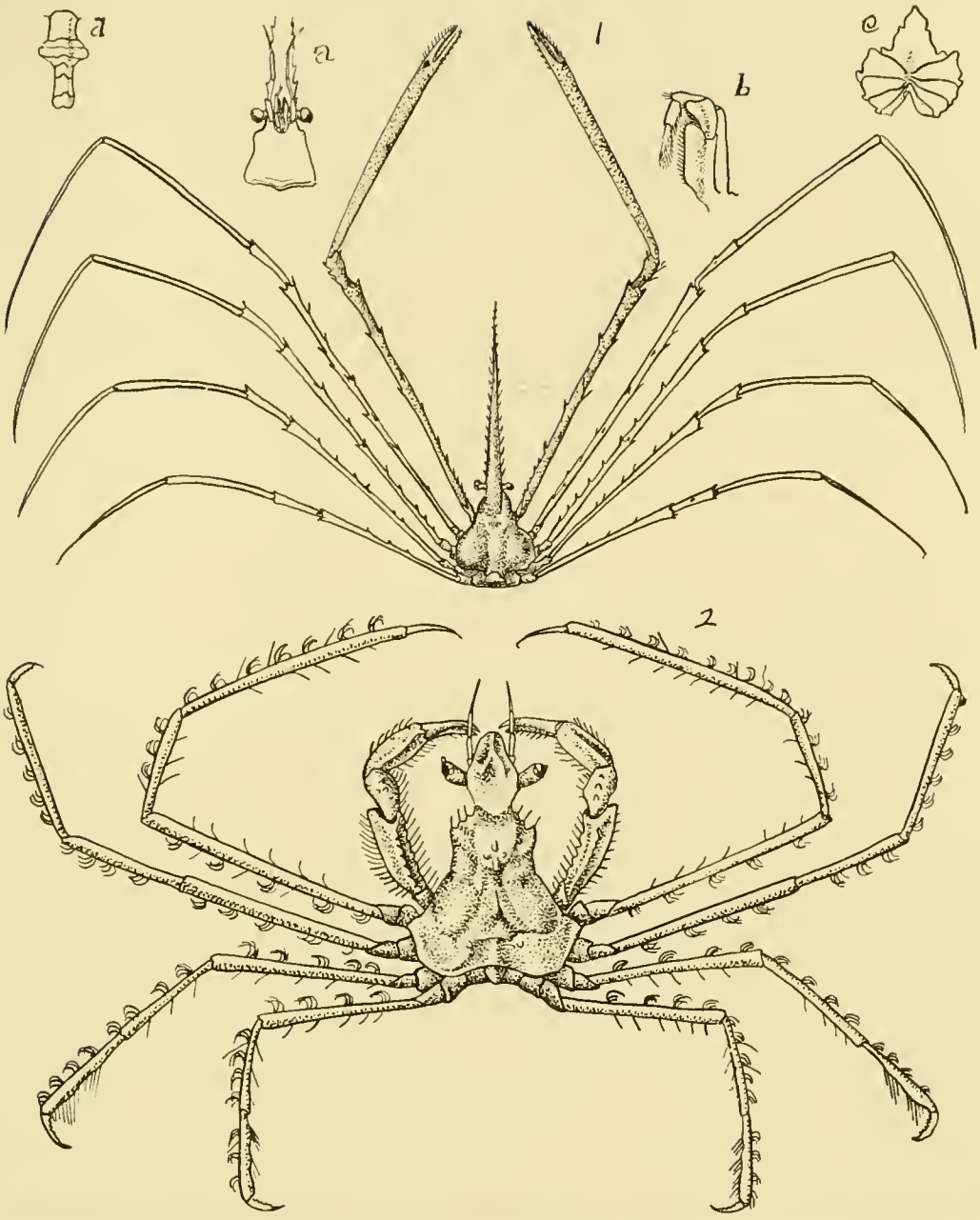


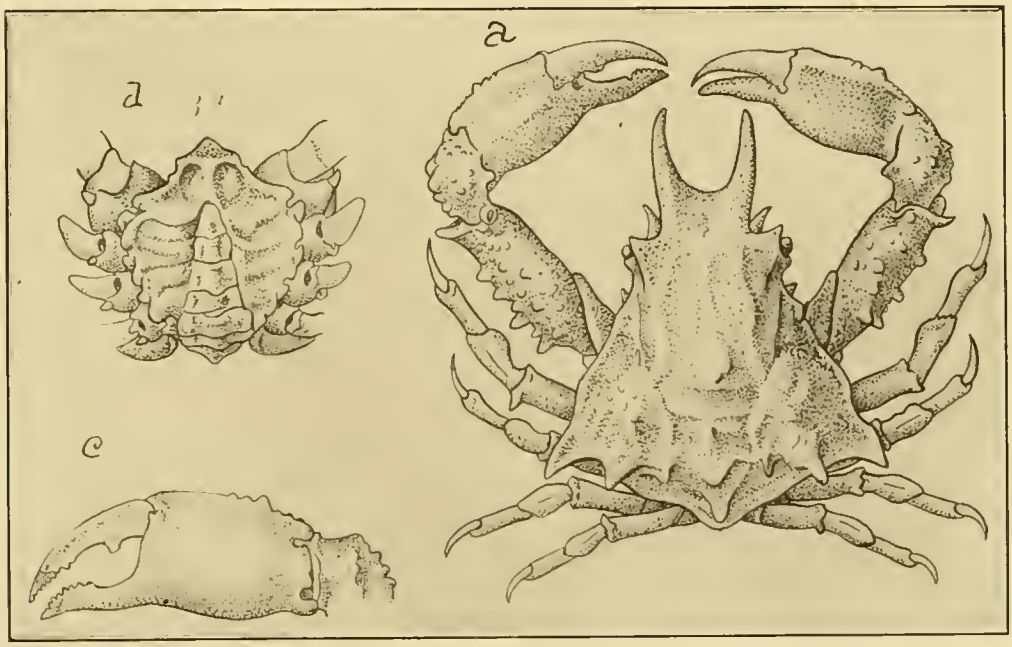
1, 2. *Achelous anceps;* 3. *Achelous depressifrons.*





1. Gulf-weed Crab, *Portunus Sayi;* 2. *Achelous Smithii* ♀ ;
3. *Callinectes marginatus, larvatus.*





1. *Stenorhynchus sagittarius* ; 2. *Podochela Riisei* ; 3. *Macrocœloma subparallellum*. After A. M.-Edw.

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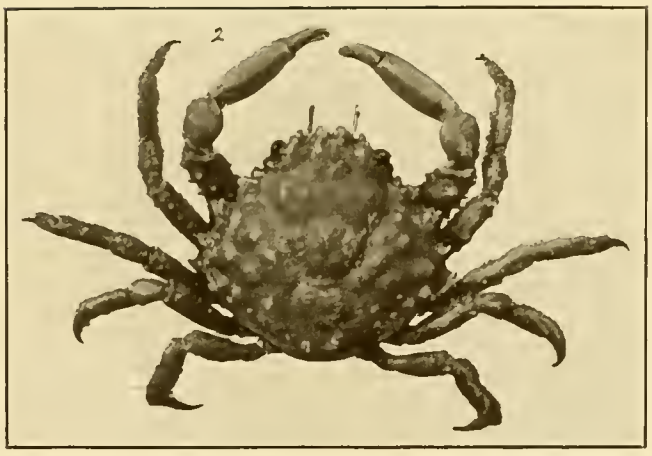
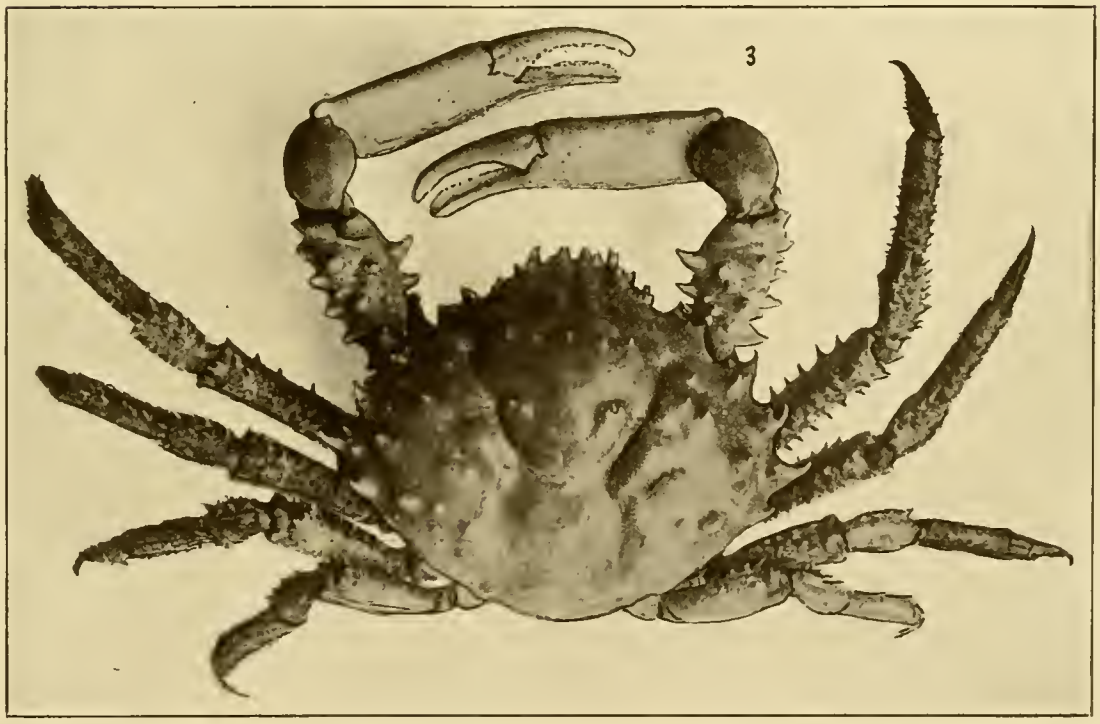
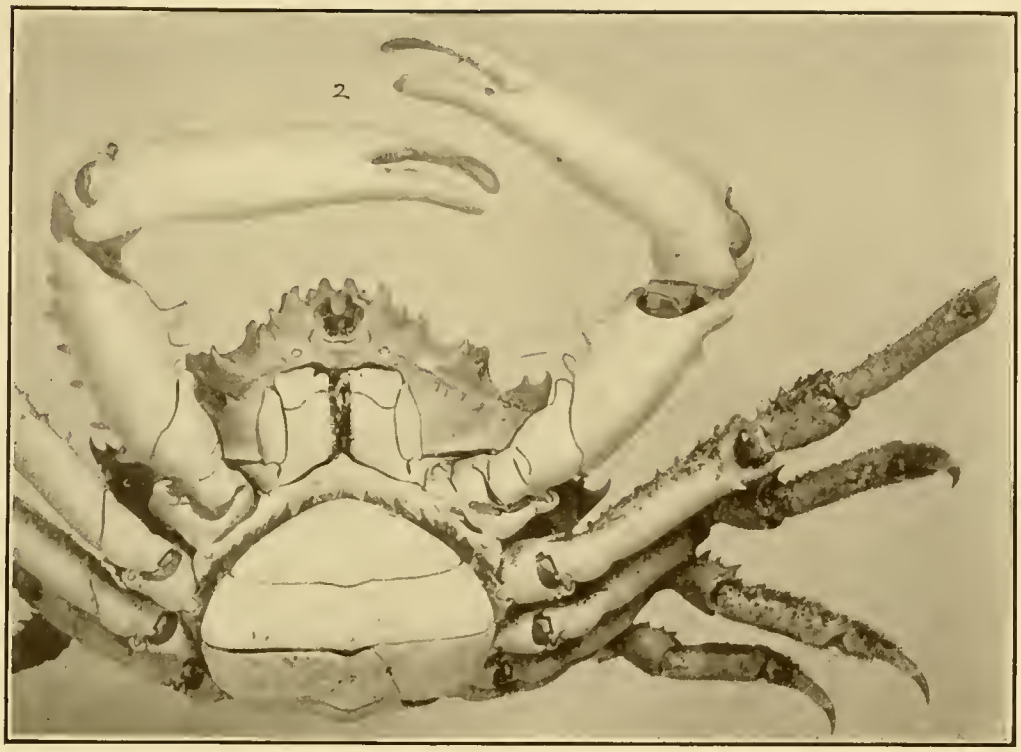
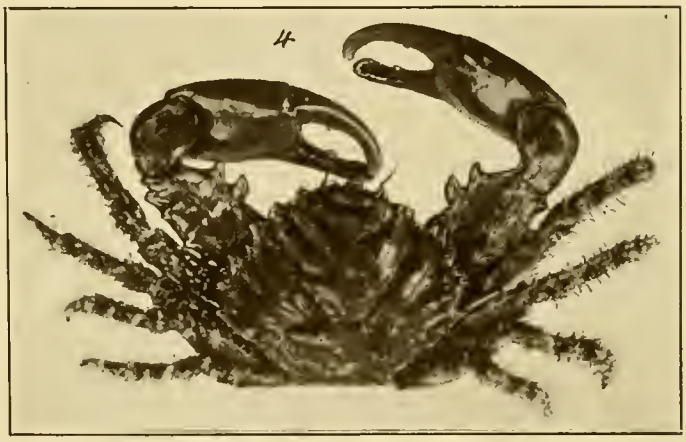
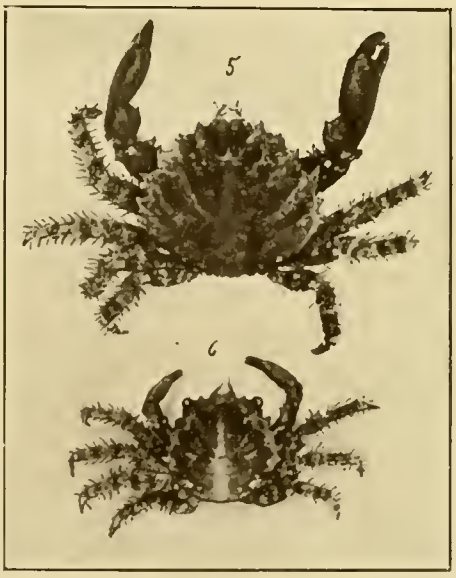




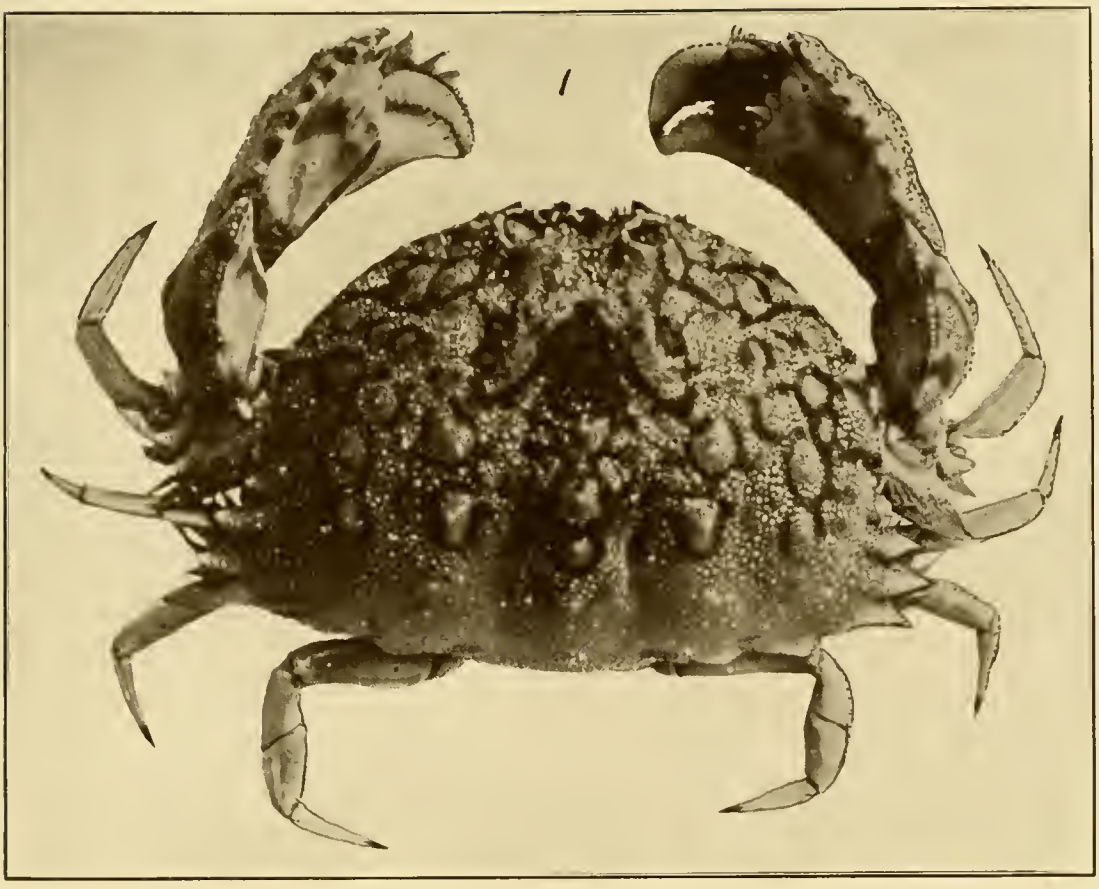
1. *Mithrax depressus?*; 2. *M. depressus?*; 3. *M. hispidus* ♀; 4. *M. hispidus* ♀.

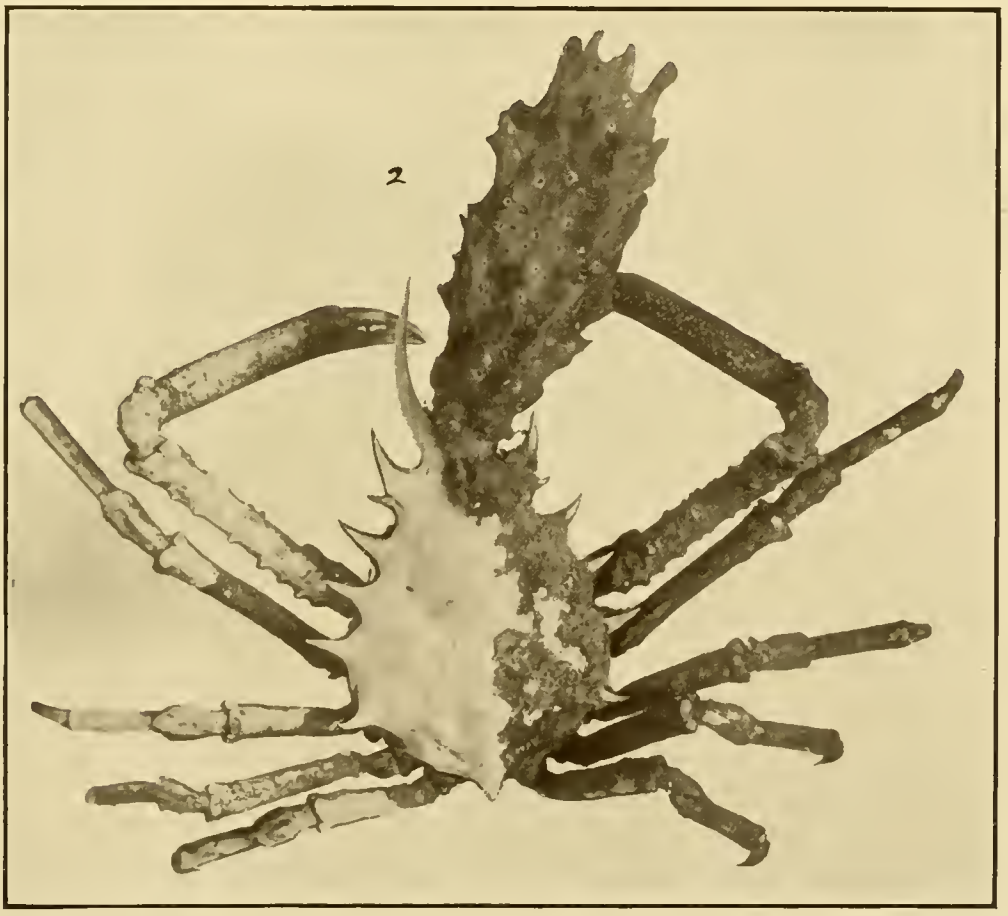




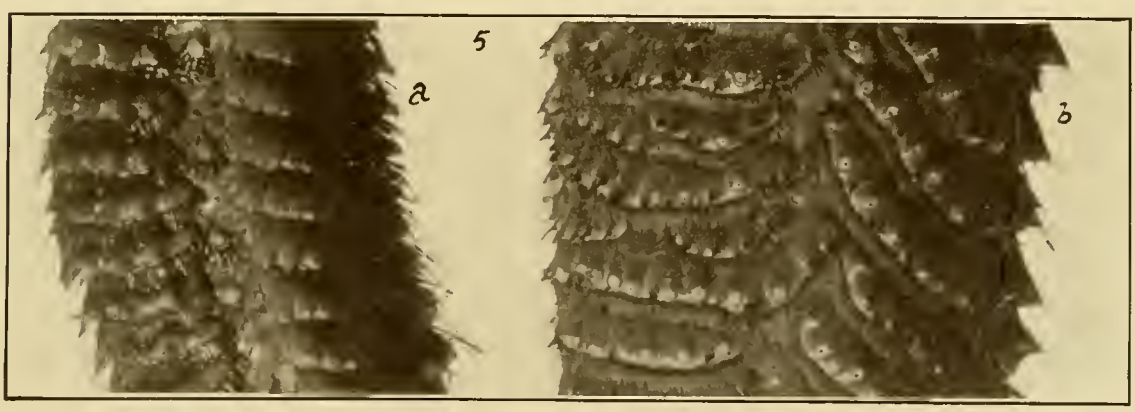


1. *Epialtus bitubereulatus;* 2. *Mithrax hispidus;* 3. *Chorinus heros;* 4, 5, 6. *Mithrax forceps, hirsutipes.*





1. Box Crab, *Calappa flammea ;* 2. *Stenocionops furcatus*, with sponge attached.



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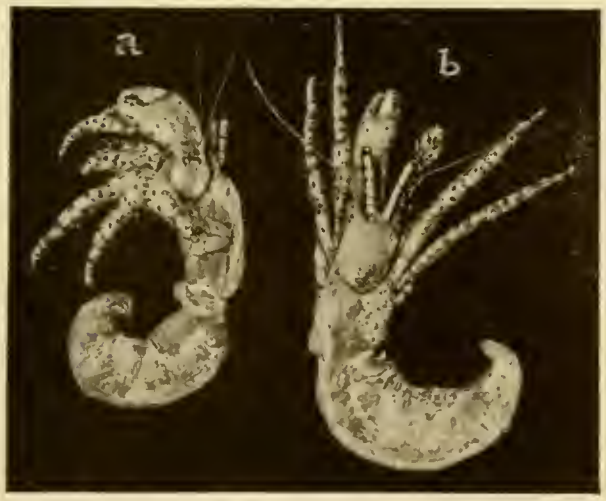

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Stoddard & Brown, eng.

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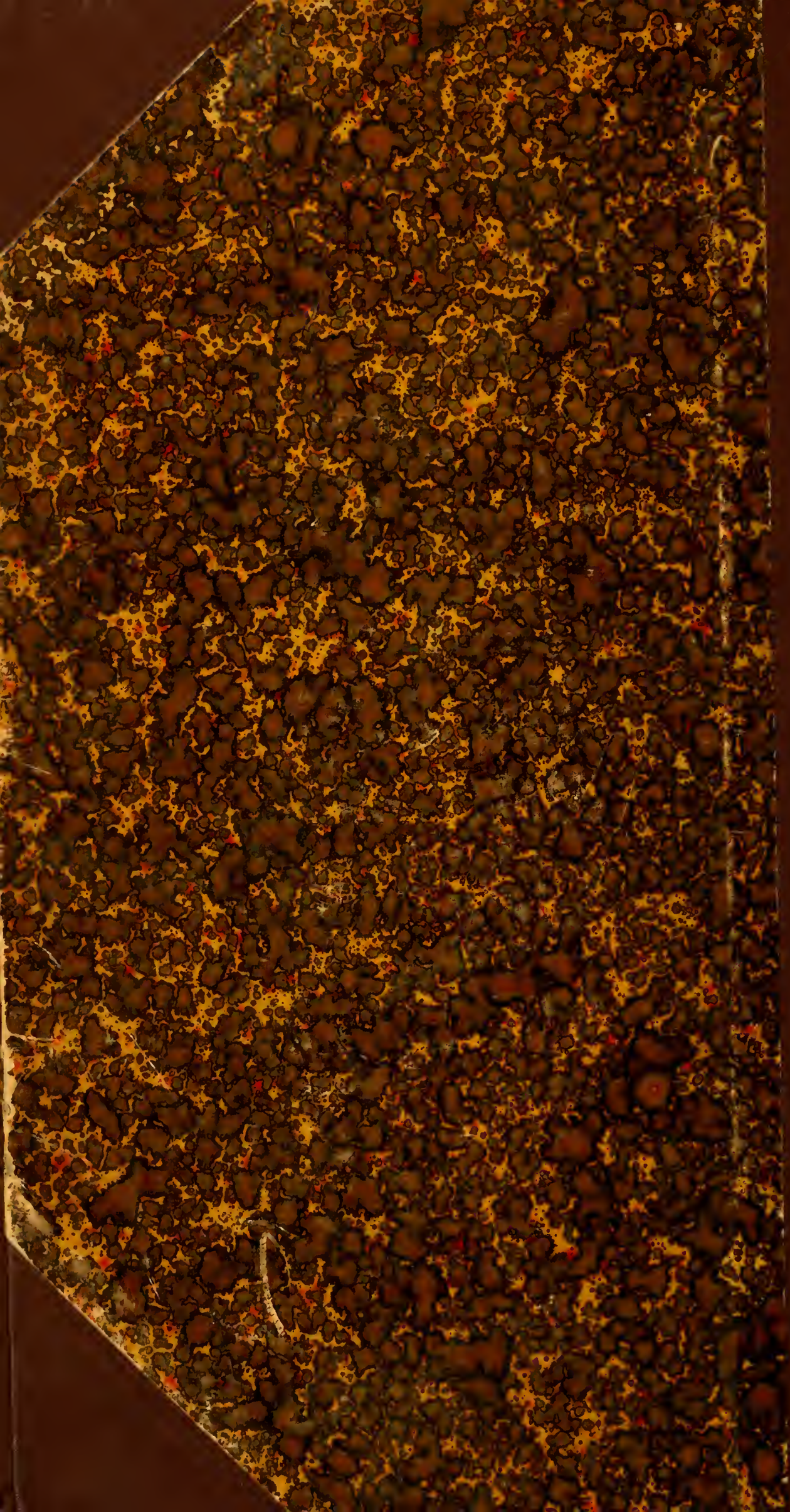
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